VOLUME 16/NUMBER 16
AUGUST 23, 1978
ACC. NOS. N78-25046 TO N78-26046

STAR
AN ABSTRACT JOURNAL

Scientific and Technical Aerospace Reports

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Scientific and Technical Aerospace Reports, Volume 16, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Informatics Information Systems Company.

The Administrator of the National Aeronautics and Space Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1981.

US ISSN 0036-8741

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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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84 LAW AND POLITICAL SCIENCE 2194
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2194
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2202
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2202
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION N.A.
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 2202
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION N.A.
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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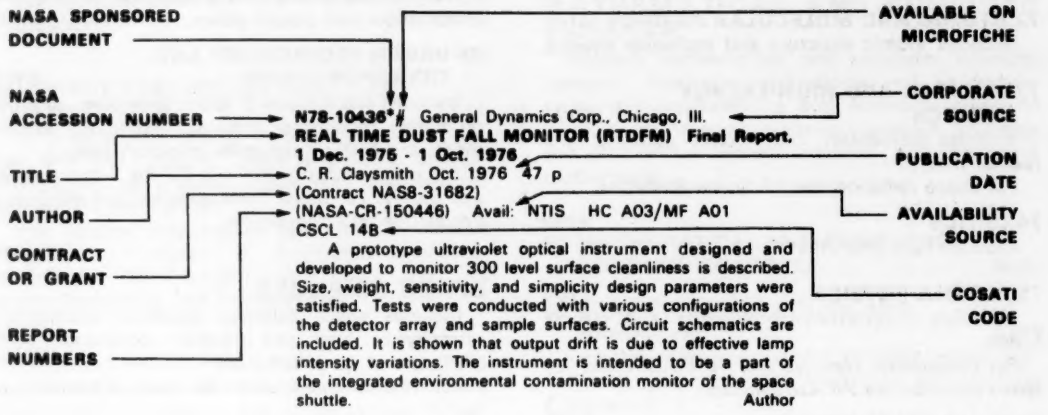
REPORT/ACCESSION NUMBER INDEX I-73

TYPICAL CITATION AND ABSTRACT


NASA SPONSORED DOCUMENT
AVAILABLE ON MICROFICHE
NASA ACCESSION NUMBER
N78-10436*# General Dynamics Corp., Chicago, Ill.
CORPORATE SOURCE
REAL TIME DUST FALL MONITOR (RTDFM) Final Report, 1 Dec. 1975 - 1 Oct. 1976
TITLE
C. R. Claysmith Oct. 1976 47 p
PUBLICATION DATE
AUTHOR
(Contract NAS8-31682)
(NASA-CR-150446) Avail: NTIS HC A03/MF A01
AVAILABILITY SOURCE
CONTRACT OR GRANT
CSCL 14B
A prototype ultraviolet optical instrument designed and developed to monitor 300 level surface cleanliness is described. Size, weight, sensitivity, and simplicity design parameters were satisfied. Tests were conducted with various configurations of the detector array and sample surfaces. Circuit schematics are included. It is shown that output drift is due to effective lamp intensity variations. The instrument is intended to be a part of the integrated environmental contamination monitor of the space shuttle. Author
COSATI CODE
REPORT NUMBERS

ON-GOING RESEARCH PROJECTS

This is a listing of research projects— not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, INTEGRATED POWER UNIT
G. WONG, Rockwell International Corp., *Canoga Park, California* 91304 (DF459090; F33615-76-C-2054)

To demonstrate a turbo power unit which can perform all the functions of both an auxiliary power unit (APU) and an emergency power unit (EPU).

Use the background available from space program to design and fabricate such a unit which will operate on JP-4.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0002, DEVELOPMENT OF MODEL TO ASSESS ENVIRONMENTAL EFFECT OF COMMERCIAL AVIATION'S HIGH-ALTITUDE CRUISE OPERATIONS
UNKNOWN, U.S. Air Force, Space & Missile Systems Org., *Los Angeles, California* 90009 (FA77WAI-720; FA59977 (TRAIS NO.))

The objective is to develop a model for use in assessing the environmental effect of commercial aviation's high-altitude cruise operations. Since present fleets are too small, it is impossible to measure the environmental effects of aircraft exhaust products. Therefore, it is necessary to use mathematical models of atmospheric transport and chemistry to derive the required understanding.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0003, MODELLING, IDENTIFICATION AND CONTROL WITH APPLICATIONS TO FLIGHT VEHICLES
A.V. BALAKRISHNAN, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (NSG 4015)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0004, STUDY TURBULENCE STRUCTURE
A. DEMETRIADES, Ford Aerospace & Comm. Corp., *Newport Beach, California* 92663 (DF139560; F33615-77-C-3016)

The function of this program is to acquire detailed measurements of turbulent fluctuation properties and Reynolds stress under adverse pressure gradient. This effort is designed to improve the computational accuracy for turbulent flows on aerospace vehicles. Many of the Air Force current aerodynamic problems can be traced back to a lack of understanding of the fundamentals of turbulence. The technical objective is to systematically investigate the turbulence structure under adverse pressure gradients and to obtain the variation of reynolds stress distribution under these conditions. The program's payoff to the Air Force will be the ability to predict turbulent boundary layer phenomenon on supersonic aircraft.

The turbulent fluctuations will be measured experimentally by means of a hot wire anemometer and a laser Doppler velocimeter on a boundary layer over a curved ramp. Correlation of these measurements will be carried out to obtain Reynolds stresses. The final product shall be the variation of Reynolds stress distribution with pressure gradient.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, DEVELOPMENT OF BORON/ALUMINUM LANDING GEAR COMPONENTS
F. DOYAL, General Dynamics Corporation, *San Diego, California* 92112 (DN581070; N62269-74-C-0619)

To evaluate the application of boron/aluminum composites to landing gear components of Navy aircraft with emphasis on component reliability. This work is in support of work unit ZA101, aircraft technology, agency accession no. DN681080.

The component selected for development is the A-7 nose gear drag brace. The conventional brace is representative of the typical steel I section components found in landing gear. This will be replaced with a tubular brace fabricated of boron/aluminum (B/Al) with titanium end fittings. The effects of damage and corrosion on static and fatigue strength of these braces will be evaluated. In total, 8 braces will be fabricated and subjected to various combinations of environments, including static and fatigue loading, foreign particle impact, and corrosion.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0006, NAVY VEHICLE DESIGN AND CONSTRUCTION: AIRFOIL OPTIMIZATION BY ADAPTIVE CONTROL OF CAMBER AND THICKNESS
E. LEVINSKY, General Dynamics Corporation, *San Diego, California* 92112 (DN475202; N00014-76-C-0742)

The objective of this investigation is to demonstrate the feasibility of a self-optimizing flexible technology (SOFT) wing which changes its shape (spanwise and chordwise distribution of camber and thickness) in such a manner as to optimize a given merit function. Such a wing will be able to automatically adapt itself to provide optimal performance throughout the whole flight envelope. This technique will also overcome existing deficiencies in both analytic and wind tunnel methods for truly optimizing airfoil and wing geometries at high subsonic and transonic flight conditions.

This investigation deals with the development and evaluation of a 1/6th scale semi-span wind tunnel model of a soft wing. The program has been divided into two phases: (a) model design, fabrication and demonstration of simplified kinematic model, aerodynamic analyses, and computer simulation studies, (b) model fabrication, calibration, test support a id data evaluation. Subsequent wind tunnel tests will be conducted under Air Force support and will be performed at Arnold Engineering Development Center (AEDC) in tunnel 16T, at subsonic and transonic conditions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0007, ADVANCED HIGH-POWER GENERATOR FOR AIRBORNE APPLICATIONS
F. ECHOLDS, Garrett Corporation, *Torrance, California* 90509 (DF460150; F33615-76-C-2168)

To demonstrate that an ultralightweight non-superconducting generator in the 1 to 10 megawatt power range can be built by fabricating and testing the rotor, which is the most critical part of the generator design. The goal is a generator specific weight of 0.1 lb/kw.

The approach will consist of utilizing advanced concepts such as enhanced conductor cooling, high-energy product magnets, high rotor tip speeds and others. The specific design concept has not been determined since a contract has not yet been awarded.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0008, PRESSURE JUMP - DULLES
A. BEDARD, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (RAA79277)

PROJECT OBJECTIVE: Continue test and evaluation of Gust Front Monitor/Warning System for Dulles International Airport and study the operational implementation of the system at other airports.

CURRENT YEAR PLAN: 1. Provide consulting services to FAA as required. 2. Continue analysis of gust front events and operation of instrumentation. 3. Continue operation of Dulles systems.

PROGRESS REPORT: Evaluation of operation of system at Dulles airport, addition of surface anemometers, and development of analysis of software and techniques.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0009, COMPRESSOR RESEARCH FACILITY
G. WRIGHT, Cadre Corporation, *Atlanta, Georgia* 30362 (DF455770)

The objective of this program is to contribute to the advance of the state-of-the-art of turbine engine compressor technology by (1) supporting exploratory and advanced development of compressor design, (2) improve compressor component characteristics, (3) determine steady-state and dynamic air flow characteristics, and (4) determine effects of steady-state and transient air flow on compressor performance.

Conduct in-house work in conjunction with the CRF contractual effort by the Cadre Corporation. Presently three problem areas are being investigated. These are quality of air flow within the test chamber, accel-decel capability of the facility drive system, and the noise generated by the facility during operation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0010, C-130 WELDBOND FUSELAGE PANEL FLIGHT EVALUATION
J.A. KITZER, Lockheed Georgia Company, *Marietta, Georgia* 30060 (DF133360; F33615-75-C-3010)

In-service demonstration and evaluation of structural hardware based on the development and application of new structures and manufacturing technology help provide the necessary confidence required for the adoption of such technology in the design and production of future aerospace systems. The objective of this effort is to conduct an in-service inspection and monitoring program to evaluate the performance of a weldbonded forward fuselage side panel installed on a C-130H aircraft. The weldbonded joining concept promises a 20-30 percent cost savings and increased structural efficiency in the development and production of future aircraft.

Visual, radiographic, and ultrasonic inspections will be conducted periodically to assess the condition of the installed weldbonded fuselage panel and evaluate this construction concept over an extended time period under service conditions. If no problems are encountered, the panel will most likely remain on the aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0011, LIGHTWEIGHT HYDRAULIC STARTER FOR AIRCRAFT 400 HP AUXILIARY POWER UNIT
W.J. ISEMAN, Sundstrand Corporation, *Rockford, Illinois* 61101 (DF452520; F33615-71-C-1695)

The objective of this program is to develop a lightweight starting system for a 400 EHP gas turbine auxiliary power unit (APU). This starting system is expected to operate reliably under all the environmental conditions experienced by military aircraft with a minimum of servicing and without the aid of ground equipment.

The contractor shall provide the necessary personnel, facilities and material to design, fabricate, and test the starting system. The program will be of 18 months duration consisting of (1) preliminary design - 3 months duration resulting in design of the starting system components, (2) system development - 9 months in duration resulting in fabrication of the system, (3) system demonstration - 4 months duration resulting in demonstrating the system can meet design goals; and (4) reporting - 2 months duration - documentation of the design and evaluation of the demonstrated starting system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0012, TEST FOR SUPERSONIC COMPRESSOR CASCADE
A.S. NOVICK, General Motors Corporation, *Indianapolis, Indiana* 46206 (DF459420; F33615-76-C-2052)

This effort concerns the effect of circumferential position of splitter vanes located in axial compressor blade passages. The principal objective is to determine experimentally if a preferred splitter vane circumferential position exists in terms of blade surface Mach number distributions and overall cascade loss coefficient. Splitter vanes have proven capable of allowing axial compressor blade rows to operate at exceptionally high aerodynamic loading. The application of these results is improved efficiency for highly loaded aircraft turbine engine compressors of lower cost and greater structural ruggedness than contemporary configurations.

An axial compressor cascade designed in an in-house Air Force program was tested experimentally in a cascade wind tunnel by this contractor, first without splitter vanes, then with vanes added. An in-house test of a compressor stage employing this splitter vane design was very successful. However, the cascade test demonstrated that the splitter vane design was not optimized. Analytical attempts at optimization have not been successful to date. Under this contract, the same cascade tested under a previous contract will be modified to allow circumferential re-positioning of the splitter vanes, and the effect of varying position will be experimentally evaluated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0013, SENSITIVITY OF NOISEMAP CONTOURS TO CHANGES IN AIRCRAFT OPERATIONS
D.K. HOLGER, Iowa State Univ. of Sc. & Tech, School of Engineering, *Ames, Iowa* 50011 (DF048520; AF-AFOSR-3308-77)

AF function - aircraft noise environmental impact. Deficiency -lack of understanding of the changes to the noise environment due to changes in aircraft type and operational procedures. Objective - obtain criteria for determining when a change in aircraft type or operation alters the noise environment sufficiently to require new noise contours for that installation. How work contributes - the Air Force will continue to operate aerospace vehicles from bases in close proximity to the civilian populace. Close cooperation with public and federal officials is necessary to maintain good relations and to comply with environmental standards. This proposal will evaluate the sensitivity of the noise level zones around an airfield to changes in aircraft operations. Better knowledge of these factors will prevent costly and time-consuming complete rerunning of the NOISEMAP contours every time aircraft operation procedures change.

Full-scale NOISEMAP evaluations for seven bases will be run. Multiple runs for each base will be accomplished for various modifications of aircraft operations and types. The sensitivity of the NOISEMAP to these modifications will be observed and criteria sought for determining threshold limits that warrant complete air installation compatibility use zones (AICUS) restudies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0014, RESEARCH IN ADVANCE FLIGHT CONTROL DESIGN

I.M. HOROWITZ, Weizmann Institute of Science, *Rehovot, Israel* (DF141040; AF-AFOSR-3355-77)

The two research projects are directly applicable to the design of flight control systems with significant uncertainty and exacting performance requirements. One project explores the usefulness of a new unconventional linear digital compensation which is multiple-faced (which presents different response functions for different inputs). The second project will explore the application to flight control of a precise synthesis technique recently developed for nonlinear uncertain plants.

This research project will intensively continue previous research, in order to determine the optimum practical exploitation of unconventional linear digital compensation which is multiple-faced in realistic control problems, and to develop practical design techniques for such exploitation. This research project will also apply the nonlinear design technique to possibly the F-4 longitudinal axis control and maybe later to a three-axes flight control system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0015, A STUDY OF NOISE AND PERFORMANCE OF PROPELLERS FOR LIGHT AIRCRAFT

K.V. INGARD, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (NAS 1-15154)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0016, AIR TRANSPORTATION RESEARCH AND ANALYSIS

N.K. TANEJA, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (NAS 1-15268)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0017, MULTIFUNCTION INERTIAL REFERENCE ASSEMBLY FOR AIRCRAFT

R. BURNS, McDonnell Douglas Astro. Co., *St. Louis, Missouri* 63166 (DF138260; F33615-76-C-3132)

In a joint AFFDL/AFAL program, establish architecture and system interfaces for a modular, redundant multifunction inertial reference assembly (MIRA) for aircraft, to provide inertial and air data information for all flight control, navigation weapon delivery and terminal area functional requirements. Successful implementation of the MIRA approach would result in replacement of numerous rate gyros, inertial platforms, vertical gyros, lead computing gyros and compass systems. Compared to the conventional approach, life-cycle cost savings approaching 50 percent are anticipated.

This investigation will first establish functional and performance requirements for MIRA based upon mission scenario of an air superiority fighter and a medium STOL transport using computer analysis. Error budgets will be derived and reliability, safety, and survivability requirements will be defined for the missions. Next, candidate inertial and air data sensing and processing technologies will be established, considering redundancy and multiplex bus requirements; these will be analyzed in detail. Detailed preliminary mechanical and electronic designs will be accomplished. Life-cycle cost and trade analyses will be conducted and system selected for MIRA concept demonstration. Test plans will be developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0018, ENGINEERING PROPERTIES OF AIRFIELD BASE AND STABILIZED BASE MATERIALS

W.H. HIGHTER, Clarkson College of Technology, School of Engineering, *Potsdam, New York* 13676 (DF049150; AF-AFOSR-3364-77)

AF function - construction of more durable airfield runway pavement bases. Deficiency/opportunity - Air Force airfields are called upon to handle heavy aircraft routinely and to maintain readiness for emergencies. Runways that are damaged unexpectedly cause interruptions in operations and leave potential gaps in military readiness. This research will contribute toward better nondestructive evaluation of runways, permitting scheduling of needed maintenance and planning of alternate readiness arrangements. Objective - to obtain predictions of Young's modulus for pavement base materials. How work contributes - the Air Force Civil Engineering Center uses a finite-element computational system as part of a nondestructive evaluation for runways used for aircraft operations. The constitutive equations used for the pavement base materials are nonlinear, and they require the use of Young's modulus as a function of the state of stress of the material. This research will provide a different method of predicting Young's modulus, and thus provide an independent check on the methods already in use.

Existing data on Young's modulus and soil stress under pavements subjected to aircraft landing and takeoff rolls will be collected, systematized, and correlated to obtain a theoretical prediction method for the stress-strain relationships.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0019, INTERACTIVE USER-ORIENTED AIRCRAFT CONFIGURATION GENERATION

E.C. EDWARDS, Battelle Memorial Institute, *Columbus, Ohio* 43201 (DF136660; F33615-76-C-3047)

Rapid methods for producing new aircraft designs are needed to assure that a large number of alternative designs are considered for the next generation Air Force aircraft. Computers are used extensively for this purpose now but the process is slow since it must be interrupted for input, output and interpretation. The objective of this work is to provide a direct interface between the individual doing the design and the computer and to facilitate interpretation through graphical displays.

The necessary associative and executive interactive graphics computer routines to integrate specified hardware and existing aircraft design software into a unified package will be developed. Emphasis will be placed on the use of data tables and graphics displays for input/output interfacing. Program operations requiring extensive knowledge of computer functioning and languages on the part of the typical user will be eliminated. Remote terminal type graphics system will permit a designer to construct, edit, and display an aircraft configuration data base.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0020, FLYING QUALITIES CRITERIA TO PREVENT PILOT-INDUCED OSCILLATIONS (PIO)

R.H. SMITH, Systems Research Labs. Inc., *Dayton, Ohio* 45432 (DF140110; F33615-77-C-3011)

The objective of this effort is to prepare recommended new requirements for inclusion in MIL-F-8785B, flying qualities of piloted airplanes. The emphasis is to be on developing new quantitative requirements to preclude pilot-induced oscillations (PIO) along with consistent revisions to the transient force requirements and pitch dynamic requirements. These revisions are necessary because present specification requirements have not prevented potentially serious PIO problems in recently developed military aircraft. Unless these criteria are developed, PIO will continue to

be a problem in future military aircraft, especially those that have high-authority stability and command augmentation systems with intentional control nonlinearities.

The approach will employ pilot-vehicle analysis methods to arrive at closed-loop criteria that account for the pilot-in-the-loop effects. More specifically, a PIO requirement will be developed on the basis of a frequency domain resonance criterion that has been hypothesized. Additional work will validate the requirement against existing data and related analysis methods. The case of longitudinal PIO will be considered in this effort and review of longitudinal control force and dynamic response requirements will be performed to define revisions that will result in a consistent set of longitudinal requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0021, CONCURRENT MULTI-TEST CAPABILITY FOR THE AFFDL AEROSPACE STRUCTURES TEST FACILITY

R.L. DENISON, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF130700)

Mission requirements of present and near future military aircraft often dictate that airframe structures be designed to operate near the upper limits of their design capabilities which, in turn, causes a great increase in dependence on testing. This increased test dependency has impacted the workload on the AFFDL Aerospace Structures Test Facility (ASTF) to the extent that during the time period of FY 74 and beyond it must be able to conduct multiple real-time test programs concurrently and with minimal increase in staffing. The objective of this effort is to develop the operational capability to more efficiently measure structural responses, process data, and support simulated environmental control functions so as to enable the ASTF to conduct, simultaneously, as many as six test programs.

A necessary first step for achieving the objective is the replacement of the ASTF data systems batch-oriented second-generation Control Data Corp. 1604B computer with a multi-task real-time system. Owned and projected procurement of Digital Equipment Corp. PDP-11 minicomputers will be integrated with the 1604B replacement to form a hierarchical system. The PDP-11's will be dedicated to specific single test tasks, and the 1604B replacement will be shared among all tasks. Overall hardware/software configurations, as well as any necessary special interfaces, will be evaulated (or designed) as required.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0022, J-85 AUGMENTOR RESEARCH

K.N. HOPKINS, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF459320)

To provide a J85 engine test-bed capability for use on four other AFAPL in-house research programs: (1) remote Raman EGT measurements, 30480570, (2) alternate fuels test, 30480569, (3) catalytic ignitor and flameholder tests, 30480571, (4) exhaust emissions survey, 30480572.

Set up a J-85-5 augmented turbojet engine in C-stand. Install a cooled emissions sampling probe for use in determining x, y, and z movement capability with a servomechanism in the x-y plane. For the alternate fuel program and the catalytic program, the engine and engine-related equipment will be in place. This program is co-sponsored TB/SF in-house combustion research activity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0023, QUIET PROPELLER CONCEPT EVALUATION

R.M. MCGREGOR, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF451910)

The objective of this program is to evaluate the noise characteristics of various tail rotor configurations to determine the noise reduction potential of various new designs. Variables to be investigated include number of blades, blade to hub phasing angles and blade length.

This exploratory research program is divided into three phases as follows. Phase I - analytical prediction. This phase consists of the development of analytical techniques to predict the performance and acoustic characteristics of the various tail rotor configurations under consideration. The prediction programs will then be used to select the final test configurations. Phase II - experimental verification. This phase consists of the experimental verification of predicted performance and acoustic characteristics utilizing the propeller acoustics static test facility. Static performance and near-field acoustic data will be acquired for representative configurations. Phase III - correlation. This phase consists of a comparison of the results acquired during phases I and II, modification of the prediction methods developed during phase I where necessary and development of design procedures for reducing propeller and rotor noise.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0024, MILITARY FLYING-QUALITIES RESEARCH

D.J. MOORHOUSE, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF132100)

The mission effectiveness of all classes of military airplanes is heavily influenced by the flying qualities of the vehicle. The effects of flying qualities can range from minor nuisance to flight safety in nature. The objective of this effort is to plan and coordinate research programs to investigate new approaches to design criteria and to establish flying qualities requirements which will insure adequate airplane characteristics for the mission needs. The results of this effort will ultimately be incorporated into military specifications mil-F-8785, 'flying qualities of piloted airplanes,' MIL-F-83300, 'flying qualities of piloted V/STOL aircraft,' and possible future specifications for remotely piloted vehicles.

This effort will consist of reviewing existing flying-qualities requirements. Joint programs will be initiated with other government agencies employing fixed base and in-flight simulation capability. New concepts in control system analysis and handling qualities specifications will be examined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0025, AUTOMATED STRUCTURAL ANALYSIS AND OPTIMIZATION

V.B. VENKAYYA, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF134020)

The severe demands on the strength requirements of the modern aerospace vehicles require optimization procedures to reduce the growing weight of these vehicles. The general objective of this effort is to develop necessary tools for integrated design of advanced aerospace structures. The specific objective is to develop methods and build capability for minimum weight design of structures with strength and stiffness requirements under subsonic and supersonic flight conditions and impulse loads such as aerodynamic gust and impact due to aircraft landing. Economy, reliability, and reduced design time are the major benefits expected from this effort.

Under the two completed work units (JON 14670111 and 14670112) optimality criteria methods were developed for minimum weight design of structures. These methods will be further developed for use in practical design conditions. Mathematical programming methods will be coupled with optimality criteria methods to handle complex design situations. These methods will be coded into computer programs to achieve the design objectives.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0026, LANDING SYSTEM RELIABILITY AND SAFETY MODEL

L.S. GEPHART, Univ. of Dayton, School of Business Admin., *Dayton, Ohio* 45409 (DF134760; F33615-74-C-3075)

No standard for evaluating the reliability and safety of a proposed AWLS configuration exists within the military or civilian agencies. The objective is to develop a model which can provide a detailed analysis of reliability/safety of the total landing

system. All configurations for both primary and back-up operations will be analyzed to enhance the safety of category III weather flight tests. The back-up modes will include human capability augmented with back-up hardware configurations. Studies using the model should be able to provide insight on obtaining the highest probability that the aircraft tests will be conducted safely in all weather landings.

The approach will be to develop a reliability/safety model of the D-141/James M. Cox municipal airport hardware configurations and the present technical order and FAA advisory circular operating procedures for category III landings. After model verification, the model will be adapted and modified to other aircraft configurations and other potential operating procedures. Finally, the methodologies of the model will be adapted and extended to other tests involving landing studies and tests.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0027, RADAR TECHNIQUES FOR AIR FORCE APPLICATIONS IN AVOIDANCE OF BIRD-AIRCRAFT COLLISIONS AND IMPROVEMENT OF FLIGHT SAFETY

S.A. GAUTHREAUX, Clemson University, School of Phy. Math. & Bio. Sc, *Clemson, South Carolina* 29631 (DF031120; AF-AFOSR-2782-75)

AF function - bird strikes continue to pose a major hazard to aviation, especially to high-speed low-altitude missions. Optical techniques offer the most promising procedures of the approaches to reduce the number of collisions. Deficiency - the influence of aircraft landing lights on bird behavior is lacking. The effectiveness of an electrooptical system in detecting aloft bird concentrations is needed. Objective - the influence of landing lights will be evaluated via airport surveillance radar and direct visual techniques. Testing of an image intensifier will continue. How research contributes - the results of this research should clarify identified problem areas. The work is identified in subarea 1.8.

Emphasis is on evaluation of a direct visual means of detecting migrating birds aloft with an electrooptical device--an image intensifier.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0028, PRODUCTION COST ANALYSIS OF RAMJET ENGINES

H. REYNOLDS, Vought Corporation, *Dallas, Texas* 75222 (DF458040; F33615-76-C-2043)

The objective of this effort is to develop a method for obtaining the production costs of parts, sub-components, components, and sub-assemblies of ramjet engines.

The methodology will address fabrication techniques and will relate cost to production steps. A building block approach will be used whereby costs of the various engine parts are additive to sub-components, sub-components are additive to components and so forth until total engine cost is obtained. The contract consists of two tasks--Task I -production costing procedures- this task consists of obtaining baseline engine cost data and using the data to develop a methodology for costing. Task II -application of cost methodology- demonstrate the method of ramjet engine costing obtained under task I.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0029, EXPERIMENTAL AND THEORETICAL INVESTIGATION OF FREE STREAM NOISE IN SUPERSONIC NOZZLES

J.C. ANYIWO, Hampton Institute, Graduate School, *Hampton, Virginia* 23368 (NSG 1505)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0030, CRYOGENIC TRANSONIC TUNNEL MODELING AND FLOW CONTROL

G.L. GOGLIA, Old Dominion University, School of Engineering, *Norfolk, Virginia* 23508 (NSG 1503)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0031, DEVELOPMENT OF ADAPTIVE LANDING GEAR FOR MILITARY AIRCRAFT - EVALUATION

J.R. KILNER, Boeing Company, *Seattle, Washington* 98108 (DF135790; F33615-76-C-3004)

Increased repair costs and reduction in aircraft fatigue life are two penalties associated with taxi-induced ground loads resulting from operation on rough austere airfields. The objective of this work unit is to evaluate active landing gear concepts for contemporary landing gear designs as a method of reducing these taxi-induced loads. Satisfactory completion of this program will result in preliminary designs of active landing gear concepts and an assessment of the resulting improvements in taxi performance. Implementing such concepts on USAF aircraft would result in increased aircraft fatigue life, reduced aircraft out of service time, and reduced owner repair costs.

Baseline taxi performance of the trailing arm, twin tandem, and 't' type landing gears as found on the YC14, KC135, and T43 aircraft will be established using digital taxi simulation techniques. Analyses will be performed to identify key landing gear parameters such as oleo spring rate and damping and their effects on landing gear taxi performance. Active landing gear concepts will be applied to each landing gear system in an attempt to optimize these key parameters for aircraft taxi. A digital taxi simulation will be used to determine improvements in taxi performance as a result of employing selected active landing gear concepts and assessments will be made with regard to increased fatigue life.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0032, AIRCRAFT DIGITAL INPUT CONTROLLED HYDRAULIC ACTUATION & CONTROL SYSTEM

G. RAYMOND, Boeing Company, *Seattle, Washington* 98108 (DF461320; F33615-77-C-2034)

The objective of this program is to establish and demonstrate hydraulic actuation system techniques that respond directly to digital input commands. The techniques will be applicable to continuous duty actuation functions such as air induction, engine inlet vanes, engine afterburner nozzles and flight controls.

A potential DEHA aircraft application will be selected aimed at establishing performance and design criteria. An analysis of promising advanced hydraulic actuation techniques, implementing multimode electronic digital inputs, will be conducted to establish its applicability to future aircraft. Based on these results, a full-scale DEHA prototype will be designed, fabricated and tested to verify compliance to performance and durability requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, DESIGN STUDIES FOR FAR-INFRARED ABSOLUTE SPECTROPHOTOMETER FOR THE COSMIC BACKGROUND EXPLORER SATELLITE

R. WEISS, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (NAS 5-24493)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

2.0002, DESIGN OF ELECTRONIC SYSTEM FOR JUPITER ORBITER PROBE
G.R. CARIGNAN, Univ. of Michigan, Graduate School, *Ann Arbor, Michigan* 48104 (NAS 5-24454)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

2.0003, INVESTIGATIONS OF VEHICLE CHARGING AND POTENTIAL (VCAP) ON ORBITAL FLIGHT TEST FOUR EXPERIMENT
P.M. BANKS, Utah Higher Education System, School of Science, *Logan, Utah* 84321 (NAS 5-24455)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

2.0004, OPTIMUM EMPLOYMENT OF SATELLITE
L.H. HORN, Univ. of Wisconsin, School of Natural Sciences, *Madison, Wisconsin* 53706 (NSG 5252)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, SOLUTION GROWTH OF CRYSTALS IN ZERO GRAVITY EXPERIMENT FOR MATERIALS PROCESSING IN SPACE
R.B. LAL, Alabama Agric. & Mech. Univ., School of Arts & Sciences, *Normal, Alabama* 35762 (NAS 8-32945)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0002, THE EFFECT OF A DISPERSED SECOND PHASE ON THE IONIC CONDUCTIVITY OF SOLID-STATE ELECTROLYTES
J.B. WAGNER, Arizona State University, Graduate School, *Tempe, Arizona* 85281 (NAS 8-32937)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0003, NAVY VEHICLE DESIGN AND CONSTRUCTION -MICROSTRUCTURE IN TITANIUM ALLOYS
K. ONO, Univ. of California, School of Engin. & Appl. Sci., *Los Angeles, California* 90024 (DN675050; N00014-75-C-0889)

Beta titanium alloys have great potential for use in aircraft structures because of their deep hardenability and ductility. The mechanical properties of these alloys depend on the structures developed through compositional control, heat treatment, and processing. This research is aimed at improved understanding of structure development as related to the above factors.

The influence of external stress on the preferential precipitation of alpha phase in beta iii alloy is being examined. Variables include aging temperature and time, grain size, and applied stress. Stress-aging experiments will be extended to alpha-beta titanium alloys such as ti 6-4 and ti 6-2-4-6 to determine the parameters that control phase transformation induced texture.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0004, A STUDY OF THE PHYSICAL PROPERTIES OF COMPOSITES
F. HOLMSTROM, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NSG 2307)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0005, APPLICATIONS OF X-RAY FLUORESCENCE SPECTROMETRY TO WATER QUALITY ASSURANCE PROGRAMS
A.C. LING, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NSG 2305)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0006, THE ACOUSTIC EMISSION FROM CRYSTALLINE MATERIALS
S.H. CARPENTER, Univ. of Denver, School of Engineering, *Denver, Colorado* 80210 (DF049530; AF-AFOSR-3395-77)

AF function - aircraft structures subject to static and dynamic loads are vulnerable to the initiation and growth of defects (e.g., cracks) which may lead to structural failures. Opportunity - often the growth of these defects gives rise to acoustic emission which can be detected and analyzed to provide a nondestructive evaluation (NDE) of the severity of the defect growth. Objective - the objective of this research is to correlate the characteristics of the acoustic signal to the type and severity of the defect origin. How work contributes -acoustic emission is a particularly desirable NDE concept because the growing defect 'calls out' its location, and one does not have to search for the defect.

The characteristics (e.g., wave shape, frequency components, amplitudes, etc.) of the acoustic emission will be related to the structural and metallurgical properties of the material and to the effect of stress states acting on the defect. Verification that a particular source is responsible for a characteristic signal will be obtained from other independent measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0007, MICROCREEP OF ALLOYS
B.W. CHRIST, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (3120516)

PURPOSE: To develop a data base on microcreep (10 to the minus 6th power cm/(cm-sec)) for design of gyroscopes used in inertial guidance systems. To develop a fundamental understanding of microcreep.

OBJECTIVES: To design and build a test system for measuring microcreep in uniaxial tension. To design and build a test system for measuring microcreep on bulk specimens subjected to hydrostatic loading. To report test system innovations in suitable media. To obtain microcreep data. To obtain microscopy data. To report microcreep data and discussions of microcreep mechanisms in suitable media.

FY 77 MILESTONES: To initiate a literature search for microcreep data on beryllium alloys, 12/31/77. To design and build a test system for measuring microcreep in uniaxial tension, 6/30/78. To obtain microcreep data on berylium alloys, 9/30/78.

SUPPORTED BY U.S. Dept. of Defense, Navy

3.0008, BASIC STUDIES RELATING TO THE SYNTHESIS OF UNSYMMETRICAL DIMETHYL HYDRAZINE AND MONOMETHYL HYDRAZINE BY CHLORAMINATION
H.H. SISLER, State University of Fla. Sys., School of Arts & Sciences, *Gainesville, Florida* 32601 (DF042070; AF-AFOSR-2915-76)

AF function - substituted hydrazines are components of several presently used liquid rocket fuel mixtures. Monomethyl hydrazine (MMH) is a major component of the fuel for the proposed space shuttle. The principal use of unsymmetrical dimethyl hydrazine (UDMH) is in the Air Force Titan II and Titan III rocket. Deficiency - due to the carcinogen nature of the presently used starting material for making UDMH, there is a need for kinetic and mechanisms studies of alternate processes for making the fuel. Objective - this research is aimed at better understanding kinetics and mechanisms of the Sisler process for

making UDMH and MMH. How work contributes - the information obtained will be exceedingly valuable in optimizing the manufacture of UDMH and MMH by the Sisler chloramination reaction.

This research is aimed at (1) determination of kinetic data for the reactions of chloramine with dimethylamine, unsymmetrical dimethyl hydrazine, monomethylamine, and monomethyl hydrazine, (2) determination of the nature and distribution of products from the reaction of chloramine with dimethylamine, unsymmetrical dimethyl hydrazine, monomethylamine, and monomethyl hydrazine, (3) mechanism study of formation of undesirable side products, and (4) study of the effect of hydroxide ion on the nature and distribution of products from the chloramine-dimethylamine reaction and then on the side reactions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0009, ULTRASONIC AND AUDIBLE ACOUSTIC EMISSIONS FROM COMPOSITE SOLID PROPELLANTS

W. STRAHLE, Georgia Inst. of Technology, School of Engineering, *Atlanta, Georgia* 30332 (DF040720; AF-AFOSR-2805-75)

AF function - this effort directly supports research objective 5.1. Many current and future Air Force weapons will use composite solid propellants as a means of propulsion. Deficiency - the burning of these and other rocket propellants are often accompanied by microscopic burn rate irregularities or roughness. Objective - this research will identify the acoustic and ultrasonic signatures as actual emissions from the combustion process and, as such, properties of the propellant. This data will serve as a combustion diagnostic of composite propellant combustion.

The audible and ultrasonic emissions from burning propellant samples of varying compositions are gathered over a wide range of pressures. Analysis of these spectra will produce the required signatures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0010, MODELLING THE DEFLAGRATION-TO-DETONATION TRANSITION IN REACTIVE SOLID PARTICLE-GAS MIXTURES

H. KRIER, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DF046070; AF-AFOSR-3115-77)

AF function - the MX missile will use high-energy HMX propellants. Deficiency - the Navy C-4 missile uses similar propellants and has experienced unscheduled detonations. Objective - this research will develop a general but accurate criterion of when deflagration-to-detonation transition (DDT) occurs in granulated solid propellants. How work contributes - permits the design of safe, reliable, high-performance missile weapons systems.

This work will include: (a) an analysis of the proper relations to express both the gas-particle drag interaction, as well as the particle-particle interaction during the non-steady, accelerating flows which occur as the flame (convective) front transits into a shock, (b) a formulation of a rigorous criterion for DDT that can be utilized unambiguously with a theoretical code which predicts pressure, velocity and flame front histories, (c) suggestions for the appropriate experiments which could eventually be carried out to verify the hazard predictions of the theoretical solutions, (d) an analysis of detonation run-up length as a function of propellant energy content, granulated loading density, an average particle size, burning rate properties, exterior wall distribution of the crack which contains the granulated bed, and (e) a better numerical integration scheme which allows shock waves imbedded in the flow.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0011, THERMOPHYSICAL PROPERTIES OF AIRCRAFT STRUCTURAL MATERIALS

Y.S. TOULOUKIAN, Purdue University, Purdue Research Foundation, *Lafayette, Indiana* 47907 (DA0F4755; DSA900 76 C 0860)

To conduct a comprehensive literature search and data survey designed to provide urgently-needed information to the laser-hardened materials and structures subpanel of the high-energy laser review group. The materials to be surveyed will be selected by a steering committee composed of tri-services representatives.

Several aircraft structural materials will be selected, and the available experimental data on required thermophysical properties for each material will be determined in order of priority.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0012, SYNTHETIC AND MECHANISTIC STUDIES IN FLUORINE CHEMISTRY 14339-C

D.D. DESMARTEAU, Kansas State University, School of Arts & Sciences, *Manhattan, Kansas* 66506 (DA0F8931; DAAG29 77 G0071)

To explore the chemistry of pentafluoroselenium peroxygen compounds, fluorinated small ring heterocyclic compounds, and oxygen-fluorine compounds. Relevance - fluorides of certain nonmetals are very energetic, highly oxidizing, while those of others are highly stable. New examples and new methods to obtain new and familiar ones could have implications for oxidizer technology for rocket propulsion and for especially stable fluorinated materials.

The synthesis of pentafluoroselenium hydroperoxide will be attempted. The mechanism of perfluoroxazirine formation will be investigated and its chemistry exploited for the synthesis of other related compounds. New methods to prepare oxygen-fluorine compounds will be developed, and their use as fluorinating agents evaluated.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0013, INTERFACIAL ENERGIES OF SOME AEROSPACE METALS AND ALLOYS

T.A. ROTH, Kansas State University, School of Engineering, *Manhattan, Kansas* 66502 (DF041660; AF-AFOSR-2868-75)

AF function - aircraft structures and turbines, exposed to the elements world-wide, suffer general and sometimes catastropic degradation. Deficiency - it is of particular interest to examine the surface and grain boundary energies of aerospace materials which oxidize or corrode with increasing severity depending upon alloy impurities, ambient gas impurities, and stress state. Objective - this research will determine the surface energy of various aerospace metals and alloys at high temperature and in various atmospheres. How work contributes - many characteristics of metals are influenced directly by interfacial energies, including intergranular corrosion, fatigue strength, creep, frictional resistance, absorption, segregation and adhesion.

The zero creep method and grain boundary grooving method will be used to obtain the surface and grain boundary of titanium, aluminum, beryllium, and alloys.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0014, RESPONSE OF HEATED MATERIALS TO SHOCK LOADING (X-RAY SHOCK)

G.E. HAUVER, U.S. Army, Terminal Ballistics Division, *Aberdeen Proving Ground, Maryland* 21005 (DA0J4541)

The objective is to investigate the response of heated aerospace materials to shock loading. Materials subjected to a radiation environment can be heated to a significant depth below the exposed surface. The shock response and subsequent failure of these heated materials is a concern in the evaluation of fratricide and lethality.

The analytical approach will treat shock propagation in one-dimensional specimens of an ablator material, an aluminum alloy, and an epoxy-bonded system consisting of the two materials. The analysis of shock propagation in systems containing heated and unheated aluminum will be performed. An attempt will be made to develop a fracture and spall model which is temperature de-

pendent for the aluminum alloy. Gas gun experiments on the individual materials and the bonded system will provide input to the analytical treatment and also assess the accuracy with which the analytical treatment predicts physical behavior. It is planned to perform uniaxial strain experiments at stress levels up to 10 kbar to investigate the Hugoniot and unloading characteristics of the ablator, as well as attenuation and dispersion effects. The dynamic yield stress of the aluminum alloy will be measured as a function of temperature. The characteristics of reflected and transmitted stress pulses in the bonded system will be investigated for comparison with computed pulses.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Labs.

3.0015, NAVY VEHICLE DESIGN AND CONSTRUCTION - SINGLE-POLYMER COMPOSITES OF HIGH-TENSILE MODULI

R.S. PORTER, Univ. of Massachusetts, School of Engineering, *Amherst, Massachusetts* 01002 (DN475508; N00014-75-C-0686)

Polymeric materials are used by the Navy in widely varying forms and functions. The properties of such materials are sensitive to the chemical arrangement and physical nature of constituent long-chain molecules. This research is aimed at the preparation and characterization of unique composites consisting of radically different morphologies of a single polymer. Such composites hold the promise of high-tensile moduli, but low cost for use in aircraft windows, impact-resistant materials and noise, shock and vibration absorbers.

Polymers will be prepared in which a sizable content of continuous (extended chain) polymer crystals are suspended in a 'normal' amorphous polymer of identical chemical composition. Such one-polymer systems will avoid the classic composite problem of failure at interfaces since the composition is chemically continuous. Because of a high crystal density for chain packing, high-density polyethylene will be used in initial preparations of one-polymer composites.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0016, MATERIALS FOR IR TRANSMISSIVE OPTIC MATERIALS

N.J. GRANT, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DF900830; F19628-75-C-0191)

AF function - development and improvement of windows for IR laser systems. Deficiency - structural defects and mechanical strengths limit the viability and operational capability of materials used for windows in IR laser systems. Objective - to determine the relationship between processing variables, hardenability, microstructure, fracture mechanics, and optical performance of IR window materials. How research contributes - this research will provide processing and characterization data for the design of improved windows for laser systems.

Theoretical and experimental studies will be made of the process variables and defect distribution and their relationship to strength properties, microstructure stability, fracture strength, and degree of polygonization in alkali halide crystals, alkaline earth crystals and other materials appropriate to IR transmissive optics. The processing parameters and the resultant properties of these materials is of critical importance to advanced AF systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

3.0017, TOUGHENING POLYIMIDE RESINS

F.J. MCGARRY, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (NSG 1504)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0018, WEAPONRY - LASER PROPULSION

D.D. HAMILTON, Avco Corporation, *Everett, Massachusetts* 02149 (DN675283; N00014-76-C-0646)

The objective of this project is to assess the utilization of laser propulsion for launching satellites into low, intermediate and high orbits as well as for orbit-to-orbit transfer and suborbital missions which can have impact on satellite defense and weaponry of Navy interest.

The contractor will carry out experiments to ascertain propellant mass, thrust produced, specific impulse and heat transfer to the walls for a pulsed laser engine. The laser interaction with a cw laser will be investigated using a 15 kw CO2 laser to study absorption both in the chamber and in the plume. Comparison of results will be made with theory.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0019, DETERMINE FABRIC DATA REQUIRED FOR TENTAGE DESIGN PROGRAMS

C.J. MONEGO, U.S. Army, Natick Research & Dev. Command, *Natick, Massachusetts* 01760 (DA0G4247)

To develop a strength vs. weight coefficient for specific fabric construction and fiber types which are to be used in design manuals for tentage. This strength vs. weight coefficient can also be used for any end item in which the forces and fabric loads can be determined, such as parachutes, conveyor belts, and life saving structures such as pressure suits, rubber boats, evacuation shutes for aircraft and other end items.

The approach to this problem is to obtain selected commercial fabrics, limited in this study to nylon and polyester fibers, test and analyze the fabrics obtained to establish a weight vs. strength coefficient for each fiber type. The selection of nylon and polyester fibers is based on the usage of these fibers in military industrial type fabrics in tents, air-supported structures and other end items. The commercial fabrics will be tested for strength under both biaxial and shear stress conditions and the fabric construction variables such as weave, fiber type, yarn count, yarn crimp and ends and picks per inch will be determined relative to their effect on weight vs. strength coefficient for each fiber type.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

3.0020, STUDY OF RESIDUAL STRESSES IN COMPOSITES AND MIXED FINITE ELEMENT FORMULATION FOR NONLINEAR MECHANICS

T.B. MCDONOUGH, Aeronautical Res. Associates, *Princeton, New Jersey* 08540 (DF044370; F44620-76-C-0122)

AF function - advanced Air Force flight vehicles require higher performance structural efficiency. Deficiency - many advanced structural concepts being considered today have inadequate basic understanding of failure criteria which place in question validity of structural design margins. Objective - the objective of proposed research is (1) to investigate the use of hybrid finite-element techniques in achieving more accurate and efficient nonlinear structural response prediction, and (2) to investigate mechanics models of residual stresses and distortion in fiber-reinforced composite structures. How work contributes - research contributes to basic understanding of failure processes necessary to establish failure criteria and margins used in design of Air Force structures.

Mixed hybrid finite-element techniques will be studied in evolving solutions to nonlinear structural response. Nonlinearities arising from both material behavior and large deformations will be studied. In addition, an investigation will be conducted into the mechanics of thermomechanical behavior of fiber-reinforced composites. Material systems to be studied include graphite-epoxy and carbon-carbon. Study emphasis will include identification of processing parameters pertinent to physical phenomena changes of material constituents and interfaces. Micromechanical modeling leading to macro response is the approach being pursued in developing an understanding of residual effects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0021, SUPERCONDUCTIVITY IN NONSTOICHIOMETRIC COMPOUNDS, LAYERS AND CHALCOGEN TERNARIES

M.J. SIENKO, Cornell University, School of Arts & Sciences, *Ithaca, New York* 14853 (DF037570; AF-AFOSR-2583-74)

AF function - high transition temperature superconducting materials are needed for application in airborne multimegawatt power generation and conditioning systems. Opportunity - research specifically directed toward the synthesis and characterization of high transition temperature metallic compounds can provide a greater margin of design efficiency and operational reliability than presently available superconductors. Objective - the aim of this research is to relate conventional chemical concepts (atom size, covalent binding, ligand field splitting, phase instability localized and extended defects) to related superconductivity effects (metal-nonmetal transitions and charge-density-wave anomalies) so as to be able to optimize conduction electron density, elastic constants and electron-phonon coupling. The special role of localized magnetic moments in quenching and enhancing superconductivity is also being examined. The overall objective is to provide a quantitative chemical and physical rationale for improving the critical properties of superconducting materials and for discovering new ones. How work contributes - the performance of high field magnets and solenoids, electric motor windings, superconducting rotors in power generators, transformers, and induction energy storage systems could be significantly improved if the upper critical field, the current carrying capacity and the critical transition temperature of the superconductor could be enhanced.

Four kinds of compounds are being investigated - (a) layered dichalcogenides, (b) metal-molybdenum-chalcogen ternaries, (c) the tunnel structure tungsten bronzes, and (d) covalent-frame metal hexaborides. High-temperature synthesis, electrochemical reduction and rf-induced boron flash reduction are used to prepare materials from ultra-pure starting elements. Chemical and structural characterization is by X-ray, electron microscope, neutron activation and ion microprobe analysis. Magnetic susceptibilities are measured by the Faraday method and electron spin resonance absorption spectroscopy. Charge density waves are monitored by electric and magnetic anomalies and by electron microscope superlattice reflections. Superconducting critical temperatures and fields are measured by Meissner effect flux-expulsion techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0022, EXPERIMENT FOR MATERIALS PROCESSING IN SPACE, PHYSICAL PHENOMENA IN CONTAINERLESS GLASS PROCESSING

UNKNOWN, Clarkson College of Technology, Graduate School, *Potsdam, New York* 13676 (NAS 8-32944)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0023, VAPOR GROWTH OF ALLOY-TYPE SEMICONDUCTOR CRYSTALS EXPERIMENT

H. WIEDEMEIER, Rensselaer Polytechnic Inst., School of Science, *Troy, New York* 12181 (NAS 8-32936)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0024, ROLLING FORMING JOINING TITANIUM ALUMINIDE SHEET

A. HOFFMANNER, Battelle Memorial Institute, *Columbus, Ohio* 43201 (DF680840; F33615-75-C-1168)

The objective of this program is to establish fabrication procedures and resulting properties for titanium aluminide base alloys rolled to sheets of varying thickness, formed into complex shapes, and joined together into scaled component assemblies typical of those used in aircraft turbine engines.

This program shall consist of three phases to be accomplished simultaneously. Phase A shall be a further investigation into sheet rolling techniques leading to thinner, wider sheet than is now available. Phase B will be an exploratory study of sheet forming by several methods. Phase C is an exploratory investigation of joining sheet materials by welding, and diffusion bonding.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Materials Lab.

3.0025, SONIC FATIGUE TESTS OF ADVANCED MATERIALS AND STRUCTURAL CONFIGURATIONS FOR APPLICATION ON MILITARY AIRCRAFT

K.R. WENTZ, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF138170)

The development of advanced structural materials has led to concepts applicable to military aircraft, some of which are particularly suitable in areas of high acoustic excitation. The objective of this program is to develop the techniques and methods required to predict the sonic fatigue life of aircraft structures with variations of the following types of joints: weldbonded, bonded joints, and advanced composite designs. Prediction methods are available for the riveted joint; however, improvements are needed in predicting a long service life and to include stiffener design effects into the life prediction techniques. The objective of this program will also include these improvements to the riveted prediction methods.

The approach is to finish the research work started with the weldbonded and bonded structural joint in which the test work was nearly completed before the closing of the AFFDL sonic fatigue facility, 31 Aug 76, to continue the shaker tests of new bonded and weldbonded systems being developed, to initiate a combined analytical and experimental investigation of advanced composite design configurations, to develop techniques needed to evaluate random fatigue strain data, to perform an analytical investigation of the stiffener design effects on the sonic fatigue life, and to provide high-cycle random fatigue shaker test data. The approach started with the weldbond and bonded joint consisted of a combined analytical and experimental program. Tests were conducted to determine mode shapes, damping, stress response, and sonic fatigue life of 40 weldbonded shaker beams, 20 bonded shaker beams, 16 weldbonded panels, and eight bonded panels. Data from these tests will be incorporated with analytical information into a design guide to predict the sonic fatigue life.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

3.0026, EXPERIMENT FOR MATERIALS PROCESSING IN SPACE PRODUCTION OF LARGE PARTICLE SIZE MONODISPERSE LATEXES

UNKNOWN, Lehigh University, Graduate School, *Bethlehem, Pennsylvania* 18015 (NAS 8-32951)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0027, DEVELOPMENT OF A PROCESS FOR PRODUCING THE HIGH-ENERGY MISSILE FUEL-TETRA-HYDRO-NORBORNADIENE DIMER

L. HALL, Sun Oil Company, *Marcus Hook, Pennsylvania* 19061 (DF457270; F33615-74-C-2064)

To develop a continuous process for the production of a blend of tetrahydro-norbornadiene dimers which will have superior low-temperature properties over the current state-of-the-art RJ-5.

The initial phase of this program will center around bench-scale laboratory tests to determine the optimum conditions which will favor the desired isomers for the following process steps: (1) purification of the raw material, (2) dimerization of the raw material, (3) hydrogenation of the dimer, (4) cleanup of the product, and (5) final purification of the product. Following this analysis, the next phase will involve scale-up to production and fabrication of a 100-500 gal/day production unit. The final phase involves the production of 2000 gallons of the fuel for AFAPL developmental evaluation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0028, CONTINUUM THEORY OF FRACTURE
M.E. GURTIN, Carnegie Mellon University, Mellon Institute of Science, *Pittsburgh, Pennsylvania* 15213 (DF043720; AF-AFOSR-3013-76)

AF function - damage tolerance of advanced aerospace vehicles is essential to reduction in Air Force cost of ownership. Deficiency - new failure criteria are needed to accurately predict the fracture process under a wide range of materials (metals and composites) and environmental states. Objective - the objective of this research is to investigate new fracture theories for metallic structures and to apply continuum mechanics based upon basic energy balance considerations and diffusion to the durability of composites. How work contributes -research contributes to improved failure-resistant designs for aircraft and solid propulsion vehicles.

Principal investigator is approaching the fracture problem as a rational treatment of energy balance. The energy of the fracture surface should be treated as a loss in binding energy caused by the creation of new fracture surfaces. Consideration will be given to the propagation of the fracture surfaces and the effects of temperature. Moisture absorption will continue to be investigated as a diffusion process in a deforming solid. Both moisture and temperature considerations will be included in the study. The influence of free and bound states of moisture in the solid will be studied as well as interfacial diffusion.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0029, MECHANISMS OF EROSION 14084-MS
N.H. MACMILLAN, Penn. State University, School of Earth & Min. Sci., *University Park, Pennsylvania* 16802 (DA0F8961; DAAG29 77 G0100)

To study erosion of materials by particles at subsonic velocities (less than approximately 3 x 10(4) cm/sec) in an attempt to identify the individual contributions of crack propagation and intersection, of plastic deformation, of impacting particle break-up, of particle-to-target adherence and of target melting to the overall erosion of a representative variety of metals and non-metals. The data would be used to make a first-order estimate of the particular combinations of erosive environment and target characteristics leading to the onset and to the maximum detrimental effect of each identifiable mechanism of material removal. Relevance - the proposed research is relevant to a number of Army problems with particle erosion in helicopter rotor and turbine compressor blades and should represent a step forward toward understanding of erosion of missile components, gun tubes, and munitions.

He would investigate the surface and sub-surface damage resulting when single crystalline and polycrystalline solids of widely differing melting points and elastic-plastic response are impacted from different directions by particles varying in size, shape, and frangibility, and moving with different velocities.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0030, CHEMICAL REACTIONS ON SUPPORTED METAL PARTICLES
J.T. DICKINSON, Washington State University, School of Arts & Sciences, *Pullman, Washington* 99163 (NCA 2-840801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0031, CHARGE TRANSPORT MODES IN NICKEL HYDROXIDE ELECTRODES
J.T. MALOY, West Va. University, School of Arts & Sciences, *Morgantown, West Virginia* 26506 (DF043440; AF-AFOSR-2987-76)

AF function - flight operations and communications depend on auxiliary battery sources for power. Deficiency - extreme temperatures, longer life, lighter weight, and higher energy batteries are needed to meet Air Force requirements. Objective - various electrochemical techniques will be used to characterize electrode behavior in various electrolyte systems, and to develop a mathematical model of the charge transport processes involving the electrodes being studied. How work contributes - results of this research will give information about electrode performance at temperature extremes, and the data will be useful in designing cells that can yield a maximum charge-discharge cycle.

Cyclic voltammetry, chronoamperometry, and double potential step chronocoulometry will be used to characterize electrode behavior as a function of cobalt hydroxide concentration in the nickel hydroxide film covering the electrodes. To attack the charge transport problem in thin-film Ni(OH)2 electrodes a theoretical model will be developed within the appropriate modification of existing computer programs to handle the boundary conditions required in electrodes of the type being studied. This sort of model would be useful in predicting the lifetime of a given electrode subjected to repeated charge-discharge cycles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, ANALYSIS OF FREE-FLIGHT ROCKET LAUNCHER DESIGN CRITERIA
J.E. COCHRAN, Auburn University, Engineering Experiment Station, *Auburn, Alabama* 36830 (DA0L4990)

To develop methods to estimate free-flight rocket systems impact dispersions. These methods will couple the launch-phase errors to the free-flight errors in a manner usable by design engineers. Effects of rocket flexibility on the launch-phase errors will be defined.

Models previously developed by Auburn University will be exercised, expanded and utilized to determine the causes and effects of launch-phase errors on impact dispersions. Current models include rocket thrust misalignment and dynamic unbalance effects. The expanded models will include effects of rocket bending or flexibility on launch-phase errors. The complex models will be simplified, while retaining the more significant errors sources, to a form readily usable by design engineers.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Ground Equipment & Materials Directorate

4.0002, TECHNIQUES FOR MISSILE PERFORMANCE OPTIMIZATION
D.W. HOLDER, U.S. Army, Aeroballistics Directorate, *Huntsville, Alabama* 35809 (DA0F1303)

In designing missile systems, the engineer is faced with a large number of system alternatives and he must select the best configuration. Modern control theory and advanced computer techniques allow computers to perform the drudgery of the task and speed design while allowing the engineer to perform the task for which he is best suited, decision making. The objective of this work unit is to develop and improve techniques for missile performance optimization.

Develop data management software to permit rapid retrieval, display and analysis of aerodynamic, dynamic and flight data. Develop improved numerical simulation techniques using tunable integration and trapezoidal convolution. Continue development and extension of the man-machine simulation capability, in particular, modeling scene perception in a time-varying environment.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Aeroballistics Directorate

4.0003, CONVECTIVE HEAT TRANSFER FOR SHIP PROPULSION SYSTEMS

D.M. MCELIGOT, Univ. of Arizona, School of Engineering, *Tucson, Arizona* 85721 (DN475299; N00014-75-C-0694)

To determine the heat transfer and fluid flow characteristics of binary gas mixtures for heat exchangers of closed Brayton cycles, applicable to advanced naval ship propulsion.

Flow and heat transfer characteristics will be determined through experiment and analytical formulation under conditions applicable to heat exchangers (heaters, recuperators, and coolers) for binary gas mixtures, including He-Xe (Prandtl numbers: 0.2 to 0.7).

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0004, LOW LIFE-CYCLE COST COOLER FOR AIR-LAUNCHED MISSILES

S.E. SPENCER, Hughes Aircraft Company, *Culver City, California* 90230 (DF137070; F33615-76-C-3096)

The problem to be solved by this effort is one of logistics and finite operational life of sidewinder type infrared air-to-air missiles. Present air-to-air missiles use open cycle J-T cooling or thermoelectric cooling. The J-T cooler has a finite operational life because of high-pressure gas storage limitations and high logistics costs because of the need for very clean high-pressure gas at remote operational sites. The thermoelectric coolers can not provide temperatures low enough for the desired sensitivity of IR guidance devices. The objective of this effort is to develop a low life cycle cost closed cycle cryogenic cooler for sidewinder type infrared air-to-air missiles. A closed cycle cooler can be operated for long periods of time and eliminates the logistics problem of providing clean dry nitrogen at remote operational sites.

A split system low life cycle cost closed cycle cooler will be developed and configured for the AIM 9l sidewinder missile. The cooler and its supporting electronics will be subjected to extensive environment, performance and life tests and then transitioned into Air Force air-to-air missiles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0005, COMMUNICATIONS - QUANTITATIVE GLOBAL MODEL OF IONOSPHERIC ELECTRON DENSITY

W.P. OLSON, McDonnell Douglas Astro. Co., *Huntington Beach, California* 92647 (DN575349; N00014-75-C-0821)

Naval and DoD communications, navigation, and surveillance systems operating at HF and lower frequencies rely on the ionosphere for propagation. Ionospheric refraction limits the accuracy of transionospheric navigation systems. The performance and utilization of these systems would be improved by the availability of a simple real-time ionospheric model.

A quantitative model of global ionospheric density is being developed which will incorporate real time measurements of solar ionizing radiation and particle precipitation provided by satellites such as SOLRAD, together with ground-based measurements. The model is semi-physical, semi-empirical in nature and will represent the major morphological features of the ionosphere such as the equatorial anomaly, the mid-latitude trough, and the polar cap together with their variations in time and space, and will provide altitude profiles of the ionosphere including the d, e, f1 and f2 layers.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0006, FLIGHT DYNAMICS SYSTEM RESEARCH

C.T. LEONDES, Univ. of California, School of Engin. & Appl. Sci., *Los Angeles, California* 90024 (DF139540; F33615-77-C-3013)

This program is for research and development in advanced control theory and technology for application to advanced vehicles and control system problems. This program will help to solve these existing Air Force problems. The objective of this program is to formulate a functional flight control design. This new design can be utilized on new aircraft systems such as AFTI.

Eleven tasks or study efforts will be investigated. Five of these tasks are essential to preliminary designs of an AFTI-type vehicle and will be emphasized. These are sub-optimal control theory for precise terminal control problems as applied to air combat or air-to-ground role. New mathematical approaches will be utilized which may tend to produce new methods to solve existing flight dynamics problems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0007, TRANSONIC WING THEORY

H.K. CHENG, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (DN123361; N00014-75-C-0520)

The development of accurate procedures for the calculation of three-dimensional flows is essential for the design and optimization of naval aircraft. This research will develop a systematic expansion method for studying the effects of lift and thickness on the inviscid transonic flow over wings and wing body combinations for wing geometries (aspect ratios) of current interest.

The transonic flow regime is one of the most difficult fields of aeronautical research because of the intrinsic non-linearity of the problem; yet it remains one of the most important from a military viewpoint. Though most of the present theoretical transonic research is directed to two-dimensional flows, real flows are three-dimensional. In the proposed research, the small disturbance inviscid equation of motion will be studied. Specifically, two different flow regimes will be examined: thickness dominated (lift may be present) and lift dominated. A lifting line theory for transonic flows will be developed. Attention will be devoted to far-field shock waves to extend the validity of the analysis to the low supersonic portion of the transonic regime.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0008, FLIGHT ATTITUDE AND ENVIRONMENT MEASUREMENT TECHNIQUES

C.R. COOKE, Sylvania Electronic Prod. Inc., *Mountain View, California* 94022 (DA0F1236; DAAH03-76-C-0145)

Develop and deliver a prototype laser tracker for measurement of rocket position and attitude in flight.

Contracted for the development of laser tracker for position and attitude measurement of flight vehicles--also for installation and testing of prototype laser tracker at micom test area no. 1. The output of the tracker will be digitized data on magnetic tape suitable for processing in MICOM software. Contract completion to be based upon performance demonstration by specified test plan in the contract requirements.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Aeroballistics Directorate

4.0009, UNSTEADY AERODYNAMIC FLOWS AND AEROELASTIC EFFECTS

H. ASHLEY, Stanford University, School of Engineering, *Palo Alto, California* 94305 (DF038980; AF-AFOSR-2712-74)

AF function - advanced aerospace vehicles. Opportunity - remove penalties in performance and airframe weight present in many Air Force aircraft because of limitations imposed by aeroelastic instability and response. Objective - improvement in the theoretical understanding of unsteady aerodynamic loads related to flight vehicles, as well as of aeroelastic phenomena in which they are involved. How work contributes -by providing the design analysts of fixed and rotary-wing aircraft with improved tools, whereby aeroelastic penalties in performance and aircraft weight can be reduced.

The fundamental principles of aerodynamics and structural dynamics will be applied in ways more sophisticated than before which take into account the increased computational capabilities of the new computers. Work planned for the immediate future will consider generalized unsteady aerodynamic forces, chordwise and arbitrary time dependent, and their effects on the aeroelastic stability of lifting surfaces, fixed as well as rotational.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0010, PHYSICAL PHENOMENA IN FLOWING PLASMAS AND AT HIGH MAGNETIC FIELDS

R.H. EUSTIS, Stanford University, School of Engineering, *Palo Alto, California* 94305 (DF042360; F44620-76-C-0024)

AF function - satellite surveillance, communication, navigation, weapon delivery and defense, penetration aids, advanced MHD power generators, laser and propulsion systems. Deficiency - insufficient understanding of the properties and behavior of flowing plasmas and their interactions with electric and magnetic fields, lack of reliable techniques for precise measurement of parameters of high temperature reacting and nonreacting flowing gases. Objectives - to better understand and develop realistic analytical models describing the plasmadynamic and combustion dynamic phenomena associated with advanced MHD power generation and laser systems. How work contributes - will provide additional understanding and realistic analytical modeling of phenomena occurring in combustion and in non-equilibrium flowing gases not now available, will provide significant improvement in measurement capabilities of high-temperature reacting and non-reacting flowing gases, will contribute to the technology base for advanced plasmadynamic power generation, laser and combustion systems with optimized properties.

This program encompasses research on physical phenomena in flowing plasmas at high velocities and on problems related to the performance of combustion mhd generators at high magnetic fields. Experimental work will include study of two-temperature boundary layers, nonequilibrium ionization, combustion diagnostics, and the effect of rapid expansions on the relaxation of mixtures of molecular species. The high magnetic field work will concentrate on the study of the effect of inhomogeneities on the prediction of performance of MHD generators. Study of boundary and instability phenomena will illuminate problems of instability control and coupling of plasmas to electrodes, including near-electrode breakdown. Diagnostic techniques will be developed for the measurement of the state of high-temperature gases containing mixtures of molecular species both under combustion conditions as well as following a supersonic expansion, important both for MHD and laser applications. Experimental data will be correlated on the basis of existing or new theoretical models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0011, MECHANICAL RESPONSE OF STRUCTURAL ELEMENTS TO DYNAMIC LOADS

G. HERRMANN, Stanford University, School of Engineering, *Palo Alto, California* 94305 (DF038650; AF-AFOSR-2669-74)

AF function - Air Force aerospace vehicles encounter time-dependent external loads during flight. Opportunity - new structural designs emerging as applications of advance composite materials and bonding techniques provide a new dimension to the study of structural dynamics. Objective - the objective of this research is to study the behavior of new structural concepts and develop theories which can be applied to accurately predict their dynamic response. How work contributes - this research contributes to the science base of structural technology.

This research will consider a number of physical models to study dynamic behavior in differing time regimes. Wave propagation behavior will investigate the propagation of different wave types in laminated composites and bonded structures. Amplitude, phase and dispersion characteristics will be the major quantities of interest in this study. Response of composite structures to moving loads representative of pressure waves will be investigated. Finally, steady-state and transient response studies will be conducted. In summary, the principal effort will be in extending approximate theories of the effective dispersion theory previously developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0012, DISPERSION RELATIONSHIPS IN TURBULENCE WITH APPLICATION TO NOISE/TURBULENCE DIAGNOSIS

K. KARAMCHETI, Stanford University, School of Engineering, *Palo Alto, California* 94305 (NSG 2308)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0013, FRACTURE OF ADHESIVE JOINTS AND ADVANCED COMPOSITES

W.G. KNAUSS, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (DF047430; F49620-77-C-0051)

AF function - advanced aerospace flight vehicles require lighter weight and greater durability to meet future mission objectives. Deficiency - the Air Force currently lacks a full understanding of the failure process in adhesively bonded joints and advanced composites. Objective - objective of this research program is to experimentally elucidate fracture phenomena under long-term conditions of polymer-based structures. How work contributes - basic knowledge of fracture phenomena will significantly aid in the development of an accurate structural fracture criteria.

Experiments will be conducted to directly observe and measure fracture of polymer-based adhesively bonded joints. Long-term exposure to mechanical stress and environmental conditions of high relative humidity and elevated temperature will be studied by these experiments. Also, fracture mode interactions will be studied at the intra-adhesive stress level.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0014, LARGE-SCALE INTEGRATION IMPLEMENTATION

J. BUIE, Thompson Ramo Wooldridge Inc., *Redondo Beach, California* 90278 (DF097140; F33615-74-C-1103)

To combine the latest advancements in integrated circuit technology with new system organizational concepts for more efficient utilization of large-scale integration. This will include providing a capability for custom LSI designs and demonstrating the cost advantages as well as reliability improvements.

The approach consists of: selection of a representative system or equipment under development and determination of the most efficient partitioning, identify any computer-aided design techniques which would complement the program goals, select device, circuit and processing technology which satisfies the cost and performance goals, and fabricate several arrays for the system and determine performance and reliability improvement.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0015, INPUT SIGNAL SYNTHESIS FOR LINEAR AND NONLINEAR SYSTEM IDENTIFICATION

H. SORENSON, Univ. of California, School of Engineering, *San Diego, California* 92038 (DF041120; AF-AFOSR-2839-75)

AF function - develop methods to model complex Air Force systems. Deficiency - the mathematical models required for analysis and design synthesis to accomplish these functions are often only marginally representative of the systems whose dynamics they model. Objective-the objective of this research program is to develop better methods for modelling dynamic systems. How work contributes - success in this effort will result in improved operational capability for important classes of Air Force systems.

Input signal synthesis techniques for system identification will be investigated and an analysis performed of the benefits of using appropriate signals. The apparent coupling between the objective function used to design optimal inputs, the structure assumed for system model, and the specific specific algorithm used to accomplish the identification will be pursued. These broad studies seem to be required in order to understand more completely the rate of convergence and general behavior of the parameter estimates provided as the output of the system identifier.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0016, SPACE TELESCOPE SCIENTIFIC INVESTIGATION USING A FAINT OBJECT SPECTROGRAPH
UNKNOWN, Univ. of California, Graduate School, *San Diego, California* 92037 (NAS 5-24463)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0017, THEORY OF HETEROJUNCTION DISCONTINUITIES 14731-EL
H. KROEMER, Univ. of California, School of Engineering, *Santa Barbara, California* 93106 (DA0E9277; DAAG29 77 G0017)

To develop a theory that determines the magnitude of the discontinuities as a function of difference between the bulk properties of the participating semiconductors, such as energy gaps, dielectric constants, etc. Relevance - several semiconductor devices used or to be used in military systems are based on heterojunctions. Infrared photodetectors for the 1-2 micron range in night vision devices derive their high efficiency from the highly controlled use of heterojunctions. Injection lasers and light-emitting diodes for target illumination or homing as well as certain high-frequency devices for radar and communication applications rely on proper choice of heterjunctions.

A preliminary investigation has shown that it should be possible to decompose the periodic potentials in the crystals into their electrostatic and their polarization (equals correlation) parts.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0018, EVALUATION OF LIGHTWEIGHT AIRCREW HELMET
J.A. VANHAASTERT, Sierra Engineering Company, *Sierra Madre, California* 91024 (DF320300; F33615-76-C-0600)

Tactical Air Command has an immediate requirement for an improved helmet for aircrews of high-performance aircraft, as stated in TAC ROC 16-72A, aircrew protective headgear. Current headgear increase aircrew fatigue and significantly impacts on aircrew ability to perform in aerospace environments of new generation aircraft. The objective of this effort is to evaluate a new helmet design concept and its impact on aircrew safety and performance, with a view toward providing guidance for operational test and evaluation hardware at the earliest possible date.

The contractor will fabricate replicates of a new helmet which incorporates unique design features intended to result in weight reduction, reduction of aerodynamic lift upon ejection, improve peripheral vision, minimum bulk, and optimal fit and comfort. He will subject the helmet to a test program including evaluation of impact protection, retention under windblast, and acoustics attenuation. The program will also provide for USAFSAM evaluation of oxygen equipment compatibility, stability during acceleration, visual fields under fixed and dynamic conditions, and other factors. Following completion of initial evaluations, the contractor will incorporate design improvements for laboratory validation and limited field trials which are to result in a final design concept. The end products of this effort will be comprehensive technical data and reports for ultimate use as biomedical guidance for development and procurement specifications.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

4.0019, OSMOTIC AND CAPILLARY PUMPED HEAT PIPES
G.L. FLEISCHMAN, Hughes Aircraft Company, *Torrance, California* 90509 (DF139780; F33615-77-C-3031)

Advanced aircraft generate large amounts of heat in critical components for which current cooling and thermal controls are inadequate. Better heat transfer devices are needed to conduct heat loads from temperature critical areas to maintain thermal control. Examples of thermal control problem areas are advanced aircraft environmental control systems which have complex controls requiring high heat rejection rates. Also, large amounts of heat are generated in aircraft wheels and tires for which heat buildup is more rapid than heat rejection. Current heat pipes having high transfer rates have limited application in large heat load transfer due to capillary pumping limits. The objective is the design and evaluation of osmotic heat pumping devices with a big payoff in the enhanced heat transport. Better thermal control of aircraft environments and other aircraft components in critical thermal areas will result in greater reliability of aircraft components with fewer failures due to high temperatures.

A contractual effort will be conducted in which experimental osmotic heat pipe designs will be evaluated, fabricated and tested, under simulation of high-temperature conditions for concept verification. After demonstration of the experimental heat pipe, a new heat pipe designed for a specific application will be fabricated for testing at AFFDL.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0020, OPERATIONAL BIOINSTRUMENTATION SYSTEM
UNKNOWN, Univ. of Denver, Graduate School, *Denver, Colorado* 80210 (NAS 9-15469)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0021, GAAS HIGH-TEMPERATURE ELECTRONIC DEVICES
D.H. GRANTHAM, United Technologies Corp., *Hartford, Connecticut* 06108 (DN590197; N00019-76-C-0673)

The objective of this program is to determine the feasibility, governing parameters and limitation of GaAs power switching devices for applications in severe, high-temperature, avionic electronic control system.

In order to achieve this objective a current switch for the 28-volt range which can control one ampere direct current via a -10v gate signal and can operate at elevated temperatures will be fabricated. This device will be life tested at 200 deg C for a period up to 2000 hours.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0022, NITRIC OXIDE MEASUREMENT STUDY
UNKNOWN, United Technologies Corp., *Hartford, Connecticut* 06108 (FA77WA-4081; FA160442 (TRAIS NO.))

The Contractor shall design and construct a narrow-line UV-absorption nitric oxide (NO) system using a contractor-owned ultraviolet spectrometer and hollow cathode lamp in accordance with the general principles employed by Arnold Engineering Development Center (AEDC). The system shall be constructed such that it shall be capable of future use in full-scale combustor test rigs although in this program testing shall be limited to the testing specified in this Work Statement. The contractor-owned spectrometer and lamp shall not be delivered under this contract.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0023, STRUCTURE OF AUTOMATIC CONTROL SYSTEMS
A.S. MORSE, Yale University, School of Engineering, *New Haven, Connecticut* 06520 (DF046570; AF-AFOSR-3176-77)

AF function - the design of aerospace and turbojet control systems. Deficiency - the control process is still poorly understood for nonlinear and time-varying systems. Objective - the objective of this research program is to develop concrete analysis and synthesis methods for dealing with the engineering problems encountered in the design of complex control and information systems. How work contributes - this work could provide new aspects from which to analyze the control design problem.

Research will be made in a number of important design problems associated with the identification and control of linear multivariable systems. Included will be a fundamental study of self-tuning systems with the objective of developing effective techniques for designing such systems so that they function reliably over a reasonable range of process operating conditions - the study is motivated, in part, by the control requirements of proposed, high-performance turbojet engines. With the purpose of realizing reliable identification and modeling procedures for dynamical systems, an investigation will be made of the basic properties of multilinearly parameterized dynamical models. An effort will be made to develop systematic procedures for parameterizing or reparameterizing process models in a form suitable for identification.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0024, COMMUNICATIONS - ADAPTIVE TECHNIQUES IN COMMUNICATIONS AND CONTROL THEORY
K.S. NARENDRA, Yale University, School of Engineering, *New Haven, Connecticut* 06520 (DN123505; N00014-76-C-0017)

The Navy has application for self-adaptive control systems in automatic control environments that arise in aircraft control systems, in process control, in filtering of communications channels, and in electronics operating in varying environments.

The work to be performed is concerned with theoretical questions of stability, effects of time-varying environments and the development of rapidly converging algorithms of control by adaptive techniques applicable for non-linear processes. Practical applications to adaptive array processors and adaptive control of aircraft systems will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0025, MULTIANGULAR SCANNING ABSORPTION-EMISSION TECHNIQUES FOR 3-D COMBUSTION DIAGNOSTICS
R. GOULARD, George Washington Univ., Graduate School, *Washington, District of Columbia* 20006 (DF049990; AF-AFOSR-3439-77)

AF function - advanced diagnostic techniques, advanced air-breathing engines, weapon delivery and defense. Deficiency - inability to obtain reliable measurement of important parameters in turbulent reacting flows in practical hostile combustion environment via present-day measuring and diagnostic techniques, inability to reliably evaluate combustion models. Objective - to develop more sensitive selective, precise, reliable and rapid diagnostic methods for measuring important parameters in jet engine reacting flow environment. To determine feasibility of using multiangular scanning absorption-emission (MASAE) techniques for obtaining high spacial and time-resolved 3-d mapping (point and profile) of species concentration and temperature in practical combustion environments, to determine capabilities and limitations of MASAE as a laboratory diagnostic tool, to provide reliable experimental data to the combustion modeler. How work contributes - will provide additional understanding and reliable data to permit realistic evaluation of analytical models of complex reacting flows, will help reduce development time and cost of air-breathing propulsion systems, will permit evaluation of capabilities and limitations of various diagnostic methods, will aid in development of improved or novel new in-situ nondisturbing techniques for accurately measuring turbulent reacting flow parameters.

The applicability of absorption-emission techniques as 3-d combustion diagnostics will be investigated. Using multiangular scanning, the traditional 'onion-peeling' method will be extended from axisymmetrical flows to arbitrary distributions of radicals and pollutants in reacting flows encountered in actual 3-d air-breathing combustion systems. A convolution algorithm already proven in X-ray absorption tomography will be tested on typical pollutant and radical concentration profile maps in flames or exhausts. The effect of the number of scans, of the viewing angle limitation, of the instrument noise will be analyzed for both parallel and fan beams. An optimized design will be proposed on the basis of these observations which will enable accurate measurement of the reacting flow field. The concept of an emission technique based on the instantaneous measurement of two fans from two windows will also be evaluated which can provide an instantaneous map of temperature and species concentration. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0026, SMOKE MEASURING INSTRUMENTATION SYSTEM
UNKNOWN, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (FA77WAI-772; FA160281 (TRAIS NO.))

Design, construct, calibrate, deliver and supervise the installation of one (1) smoke measurement instrumentation system in the C-124 full-scale evacuation test facility at the Civil Aeromedical Institute (CAMI), Oklahoma City, Oklahoma. This system shall consist of twenty (20) smoke meters.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0027, AIRCRAFT/WEAPONS AERODYNAMIC HEATING
J.C. KEY, U.S. Air Force, Armament Laboratory, *Eglin Air Force Base, Florida* 32542 (DF626610)

To develop an in-house cability for analytically predicting fields of aero-thermodynamic and transport properties required in aerodynamic heating analyses of USAF airframe/store bodies of concern to the AFATL, over existing/anticipated operational flight envelopes. These fields of properties, along with specific geometrical and thermal property specifications of the airframe/store bodies under consideration, are required to determine transient thermal responses and steady-state temperatures, i.e., temperature fields throughout the bodies.

Investigate existing capability for analytically predicting aerothermodynamic (velocities, viscosities, temperatures, etc.) and transport (effective convective heat transfer coefficients) air properties. Using these techniques, develop a method whereby fields of the above-mentioned properties may be predicted for surfaces of selected USAF airframe/store bodies over a range of flight envelopes. This effort is confined to the aero-thermodynamics of adiabatic compression and viscous heating--transient thermal responses of airframe/store bodies are not intended for inclusion here under.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

4.0028, BOUNDARY INTEGRAL FRACTURE MECHANICS CODE
W.E. CARROLL, State University of Fla. Sys., School of Engineering, *Orlando, Florida* 32816 (NAS 8-32835)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0029, LINEAR AND NONLINEAR EFFECTS IN THE VIBRATION OF ELASTIC STRUCTURES
L.W. REHFIELD, Georgia Inst. of Technology, School of Aerospace Engin., *Atlanta, Georgia* 30332 (DF036040; AF-AFOSR-2479-73)

AF function - advanced aerospace flight vehicles will require improved performance and durability to meet future mission objectives. Opportunity - advanced composites are under investigation to provide the desired improvements. However, knowledge of the structural dynamic behavior of composites is essential prior to large-scale applications. Objective - objective of this research is to investigate the influence of moisture and elevated temperature on the linear and nonlinear dynamic behavior of composites. How work contributes - this research is contributory to a multidisciplinary research activity studying the behavior of advanced composites.

This research project involves both theoretical and experimental activities. Experiments will investigate extent to which environmental effects influence dynamic structural behavior in flexure. Both linear and nonlinear frequency and damping properties will be studied. Theoretical effort will extend the previously developed nonlinear theory to include rotational and transverse shear effects. In addition, viscoelastic effects will also be incorporated in the theory in order to assess its importance when comparing predictions with experimental data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0030, EXPLOSIVE VAPOR CHARACTERIZATION
UNKNOWN, I I T Research Institute, *Chicago, Illinois* 60616 (FA77WA-3940; FA160132 (TRAIS NO.))

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0031, AN INVESTIGATION OF INSTANTANEOUS HEAT TRANSFER RATES IN THE EXHAUST PORT OF AN INTERNAL COMBUSTION ENGINE 13876-E
S.C. SORENSON, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DA0E9148; DAAG29 76 G0265)

To obtain better understanding of the instantaneous heat transfer at the exhaust port of four-stroke cycle internal combustion engines. Relevance - this research is directly supportive of improving engine efficiency and as such supports a major objective of the TASDC. In addition, the results will aid a better understanding of the problems encountered in the mini-cooled engine, a TASDC project of high priority and potentially of considerable significance in overall engine improvement.

Experimental measurements will be made of the instantaneous value of gas temperature, pressure and velocity, and instantaneous port wall temperatures in the exhaust port of a four-stroke cycle spark ignition engine. Instantaneous values of the local heat transfer coefficients will be obtained from these data. These coefficients will be nondimensionalized where such generalizations are valid.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0032, THE INTERACTION OF SOUND WITH TURBULENT FLOWS
V.W. GOLDSCHMIDT, Purdue University, School of Mechanical Engin., *Lafayette, Indiana* 47907 (DN475382; N00014-75-C-1048)

Control, propulsion and acoustic aspects of naval vehicles are all dependent on the characteristics of turbulent boundary layer flows. The results of this research on the interaction of sound and turbulence should lead to improved understanding and more accurate predictions of turbulent flows and, thus, to improved designs of vehicle systems and components.

This is a continuation of an ongoing experimental and analytical study of the interaction of sound with an incompressible plane turbulent jet. The effort will include completion of two Ph.D. thesis investigations: (1) on changes in turbulent structure due to acoustic input; and (2) on the flapping motion of a turbulent plane jet. In addition, research will continue on the measurement of interface foldover with an acoustic disturbance.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0033, STRUCTURAL RESPONSE ANALYSIS
J.M. SANTIAGO, U.S. Army, Ballistic Research Labs., *Aberdeen Proving Ground, Maryland* 21005 (DA0M4547)

The objectives are to enhance and augment existing structural response computer code capabilities in order to more realistically assess blast and fragment induced damage to complex engineering structures used by the Army (such as helicopter airframes, armored vehicle bodies, equipment shelters, reentry vehicles).

Effort will be made to acquire and implement on the BRL computer the most suitable finite-element structural dynamics program capable of treating the nonlinear anelastic transient response of bulkheaded, stringered shell structures typical of airframe and armored vehicle construction. The initial phase of the effort would involve a literature search and evaluation of existing programs. After implementation of the program, suitable modifications to enhance treatment of new problems as encountered will be made. A subsidiary effort will be performed to enhance the strain predictions and boundary modeling capability of our in-house finite-difference structural response program, REPSIL, and to modify the REPSIL/PETROS family of programs to treat cutouts and access openings by coding internal free edge boundaries.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Labs.

4.0034, EXPERIMENTS ON SHEARED OR STRAINED TURBULENCE
S. CORRSIN, Johns Hopkins University, School of Engineering, *Baltimore, Maryland* 21218 (NSG 2303)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0035, SLANT VISUAL RANGE MEASURING EQUIPMENT TECHNIQUES
E.Y. MOROZ, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF243790)

AF function - navigation and weapons delivery functions of strategic, tactical, air defense, and airlift forces. Deficiency - the requirement for a slant range visibility measuring system for airfield use is stated in MAC ROC 3-73. Objective - the objective is to develop a lidar slant range visibility measuring system to determine visibility in the approach zone under category I, II and IIIA operations. How development contributes - a lidar slant visual range system will provide for safe and efficient aircraft operations at airfields.

An experimental SVR measuring system and real time data processor will be field tested. Comparisons will be made with simultaneous slant path transmission measurements. Time and space measurements of the visibility field collected during slant visual range experiments will be analyzed to determine the optimum operational configuration and data acquisition rate for a lidar slant visual range measuring system. The study will also determine which type of visibility information best characterizes for the pilot, the slant visual range, and its variability in the approach zone.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0036, SPARSE LINEAR SYSTEMS - KEY TO IMPROVED COMPUTATION IN ENGINEERING DESIGN
D.A. ROSE, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (DN223809; N00014-75-C-0243)

A common thread which ties together much of engineering design is the necessity of solving very large sparse systems of linear equations. The ability to solve such systems is often the limiting factor in the solution of problems in fluid mechanics which model flows about ships and aircraft or geophysical fluid phenomena of weather or ocean currents. Engineering design and operations analysis problems frequently involve optimization (mathematical programming) techniques. The use of appropriate sparse matrix methods is a key element in obtaining good performance from optimization algorithms. This project will both develop improved sparse matrix techniques and explore the application of these and related techniques to the computer solution of various specific problems of Navy interest.

New techniques for the computer solution of sparse linear systems and for the solution of related combinational problems will be developed and analyzed. Consideration will be given to the design, analysis, implementation, and application of the computer

algorithms which implement these techniques. The applicability of these new techniques to various specific problem domains (e.g., numerical modeling of the ocean) will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0037, CURRENTS AND CHARGES ON CYLINDERS IN A PARALLEL PLATE TRANSMISSION LINE

T.T. WU, Harvard University, School of Engineering, *Cambridge, Massachusetts* 02138 (DF044580; AF-AFOSR-3073-76)

AF function - the determination of the magnitudes and distributions of surface currents and charges induced on the metal skin of aircraft when exposed to a possible electromagnetic pulse (EMP) from a high-altitude nuclear burst is both theoretically and experimentally a difficult problem. The experimental approach is to make direct measurements with sensors distributed over the surface of an actual aircraft when it is illuminated by a simulated EMP. One form of simulator is the parallel plate device such as ALECS, ARES and the proposed trestle structure at the AFWL. Deficiency - it is not obvious nor is it easily proved that the field in the parallel plate section has the characteristics of an EMP. This program will aid in answering that issue. Objective - the intent of this work is to make measurements in a scale-model parallel plate simulator and compare these measurements with the distributions of induced surface densities of current and charge in relative amplitude and phase on an obstacle in a configuration known to launch a plane wave field. Contribution - this work will provide important direct evidence about the efficiency of a parallel plate simulator.

The model simulator developed for measuring the amplitudes and relative phases of surface currents and charges on single thick cylinders will be employed to make selected measurements on crossed thick cylinders and a vertical cylinder with flat plates as horizontal arms over a ground plane. A study of the analytically determined field distributions in these structures and their dependence on dimensions and frequency will be obtained.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0038, CLOSED-LOOP ROLL CONTROL FOR MAGNETIC BALANCE SYSTEMS

E.E. COVERT, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (NSG 1502)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0039, PACKET SPEECH

B. GOLD, Mass. Inst. of Technology, Lincoln Laboratory, *Lexington, Massachusetts* 02173 (DF306616; F19628-76-C-0002)

The objective of this program is to develop and demonstrate techniques for efficient digital speech communication on networks suitable for both voice and data, leading eventually to better interaction between people and computers. This work is carried out in conjunction with other ARPA contractors in the network speech compression (NSC) group sponsored by the Information Processing Technology Office of ARPA.

In FY 77 the issues involved in permitting conversational speech and conferencing in a packet satellite network will be investigated with the aid of a satellite conference simulation facility. Effort will be directed at developing high-quality low-bit-rate speech coding algorithms that are amenable to small and expensive CCD implementation. The phrase recognizer developed in FY 76 will be integrated into a user interface through which people can conveniently interact with the facilities available on an integrated voice-data network.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Electronic Systems Div.

4.0040, ELECTRICAL CHARACTERIZATION OF LINEAR INTEGRATED CIRCUITS

J. KULPINSKI, General Electric Company, *Pittsfield, Massachusetts* 01201 (DF736480; F30602-76-C-0345)

To characterize specific linear integrated circuits, develop and evaluate electrical test procedures and generate detailed test and burn-in requirements for military specification of these devices for inclusion in MIL-M-38510 slash sheets. Detail slash sheets will be generated/reviewed with the specific devices to be determined by RADC based on highest usage and potentially high-usage devices for which a specification requirement exists.

For each device-type slash sheet, the specification/test circuit design shall be evaluated where possible using at least ten devices from three different sources. The devices to be considered under this effort will be selected as requirements arise. Device types will include standard-level complexity devices such as those presently in the MIL-M-38510 linear specification series and will cover voltage regulators, high-frequency amplifiers, phase lock loops, analog gates, etc. Any bidder should have previous experience and be familiar with the military specification system and should also have previous experience in the generation of electrical test requirements for commercial procurement of linear integrated circuits. Due to the nature of this effort, this procurement should be restricted to a user activity to prevent any manufacturer bias. End item will be draft military specification slash sheets for MIL-M-38510, and a final report to contain the evaluation test results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0041, ADVANCED REENTRY AEROMECHANICS

M.L. FINSON, Physical Sciences Incorporated, *Wakefield, Massachusetts* 01880 (DF038030; F44620-74-C-0022)

AF function - aerospace vehicles. Deficiency - the transition of laminar boundary layers to turbulent ones has always been difficult to predict quantitatively except in familiar ranges of the pertinent parameters, such as Reynolds number, Mach number and surface roughness. When these parameters enter unfamiliar ranges, and when entirely new parameters are brought into action, such as real gas effects, background turbulence, streamline curvature, ablation, and others, accurate prediction becomes very elusive. Accurate prediction capability is needed to improve the performance and decrease the cost of thermal protective and aerodynamic components of aerospace vehicles. Objective - to construct useful correlations of reentry boundary layer transition measurements which take into account all of the significant parameters. How work contributes - the accurate prediction of transition to turbulence can greatly improve the design procedures for thermal protective components by removing the necessity of expensive overdesign to allow for uncertainties now being experienced. At the same time, an accurate prediction capability also implies knowledge that would lead to some control over transition locations, affording a limited possibility of deciding where transition is desired and then tailoring the design to put it there.

Available ground test data and free-flight measurements will be analyzed by means of available computer codes. Analytical models will be constructed and tested against the available data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0042, EFFECTS OF HORIZONTAL FIBER LAYERS IN PAVEMENT SYSTEMS

G.M. HAMMITT, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180 (DA0X8180)

To determine the reinforcing effect of thin horizontally oriented fiber cloth and fiber membrane layers placed between normal pavement layers or between the pavement structure and subgrade of various military road and airfield pavement systems.

Document through field performance surveys and design data reviews recent qualitative engineering reports of pavement performance benefits derived from internal placement of horizontal fiber cloth layers in flexible pavement sections. Explore and isolate primary reasons for improved performance through analysis and component laboratory and field tests; filtering action, pore water pressure dissipation and resistance to horizontal torsional forces will be investigated. If successful in validating and quantifying the improved performance, follow-on efforts to develop design and construction criteria will be initiated.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Corps of Engineers

4.0043, PAVEMENT PERFORMANCE EVALUATION
P.J. VEDROS, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180 (DA0M8182)

The objective of this study is to develop methodology for rating the performance of pavement systems on Army airfields, heliports, roads, and streets. The rating system developed will be based on the projected remaining functional life of the pavement.

The study will consist of developing the parameters necessary for establishing an index of the performance of a pavement system and the manner of measuring these properties with appropriate equipment. Pavements will be rated based on the physical characteristics measured, and the rating will enable maintenance and repair funds to be allocated on a priority basis where needed.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Corps of Engineers

4.0044, LOAD DEFLECTION CHARACTERISTICS OF INFLATABLE STRUCTURES
J.R. BAUMGARTEN, Univ. of Nebraska, School of Engin. & Technology, *Lincoln, Nebraska* 68508 (NSG 1506)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0045, ANALYTICAL STUDIES OF TURBULENT FLOW FIELDS
G.L. MELLOR, Princeton University, School of Engin. & Appl. Sci., *Princeton, New Jersey* 08540 (DF028700; AF-AFOSR-2756-75)

AF function - advanced aerospace vehicles. Opportunity - increase capability for predicting separated turbulent flow problems. Objective - to develop a theoretical model and a numerical method useful for solving fully separated turbulent flows produced by steps, flat plates, and adverse pressure gradients normally encountered on lifting surfaces. How work contributes - improvement in predictive ability will permit better design of any system (airfoils, inlets, compressor and turbine blades) in which separated flows are important.

A second moment turbulence model centered on hypothesis by Rotta and Kolmogorov has been developed to handle fully separated flows. Various separated flows will be examined and predictions compared to available experimental data. These will include flows where curvature effects are dominant, unsteady (ensemble mean) flows over bluff bodies, and internal waves in density stratified flows.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0046, RESEARCH AND DEVELOPMENT OF ANTENNAS FOR RESEARCH ROCKET AND SATELLITE APPLICATIONS
D.G. HENRY, New Mexico State University, Graduate School, *Las Cruces, New Mexico* 88001 (DF277800; F19628-75-C-0072)

AF function - command, control and communications. Deficiency -reduced effectiveness of systems for acquiring reliable telemetry data from R&D research probes, and for exercising command and control of these vehicles. Objective - to develop improved antennas for telemetry, tracking and command systems in research probes. How research contributes - the development of highly reliable antennas will increase the effectiveness of instrumentation systems used to support AF R&D rocket and satellite programs. Design and development will be based on specific type of research vehicle to be instrumented. Antennas developed will be tested on an antenna range and on the research probe when possible. The design goal is to develop type acceptable antenna systems for AF R&D rocket probes and satellites. Improved reliability of systems for telemetry data transmission, trajectory determination, vehicle command and control, or other electromagnetic transmission and reception applications will be the final objective of this work.

The technical approach will include design and development of antenna systems for various research and rocket payloads. Developments will proceed from mockup tests, to prototype units to flight tests. Type acceptable systems will be developed to satisfy the electrical and aerodynamic requirements of the various types of aerospace vehicles. Antennas will be provided for telemetry, tracking, recovery, command and control applications.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0047, OBSERVING DATA ANALYSIS AND INSTRUMENTATION PROGRAMS
E.P. MOORE, New Mexico Inst. Min. & Tech., Graduate School, *Socorro, New Mexico* 87801 (NCA 5-78)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0048, VISCOUS AND INVISCID INTERACTION IN THE HYPERSONIC FLOW REGIME
M.H. BLOOM, Polytechnic Inst. of New York, School of Science & Engin., *Brooklyn, New York* 11201 (DF040290; AF-AFOSR-2787-75)

AF function - advanced aerospace vehicles. Opportunity - gain a deeper insight into the mechanism of film cooling on a blunted slender cone. Objective - study film cooling on a blunted slender cone. In particular, effects of transition from laminar to turbulent flow and angle of attack will investigated. Develop a diagnostic technique for two-phase flows. How work contributes - this work will provide the basic knowledge which can be applied to the design of the next generation of maneuverable reentry vehicles.

A combined experimental and theoretical program will be developed. In the area of film cooling a larger model has been built and thin film surface gauges installed. Tests will be run at various angle of attack regimes including those in which three-dimensional effects play a role. Available theoretical and numerical analyses will be applied in order to see if it is possible to correlate the measurements to existing methods. In the diagnostic technique development an argon ion laser will be combined with a tunable dye laser to provide the narrow coherent beam needed for desired resolution and detection of liquid water.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0049, TRANSONIC SEPARATED FLOW STUDIES FOR NAVAL AIRCRAFT
R.J. VIDAL, Calspan Corporation, *Buffalo, New York* 14221 (DN123228; N00014-76-C-0630)

The performance of aircraft at transonic speeds is severely limited during maneuvering by adverse shock-boundary layer interactions and flow separation on the wing. Though the effects of these phenomena on the aerodynamic characteristics have been studied in the laboratory, the measurements have inadequately simulated viscous effects - resulting in serious problems when the laboratory data have been applied to the design of full-scale aircraft. The present investigation will study, experimentally, shock boundary layer interaction at transonic speed with full-scale viscous simulation to provide basic data leading to a more complete understanding of these complex flows and to provide for the development of viscous scaling laws.

Accurate aerodynamic data for aircraft and missile design needs require matching the Reynolds number as well as the Mach number in laboratory tests. Because of the extreme expense of conventional laboratory equipment to accomplish this match at transonic speeds, such testing has usually been performed at reduced Reynolds numbers--leading in several instances to serious airplance deficiencies. The present investigation will study shock boundary layer interaction at full-scale Reynolds numbers at transonic speeds in a short-duration tube wind tunnel. Though the running time will be short, about 40 milliseconds, sufficient time will be available to develop steady flow, and enable total pressure and static pressure surveys to be made. In the interaction

region, the surface shear and wall static pressure will be measured.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0050, SCIENTIFIC INVESTIGATIONS IN SUPPORT OF THE SPACE TELESCOPE PROJECT
J.J. CALDWELL, State University of New York, Graduate School, *Stony Brook, New York* 11790 (NAS 8-32904)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0051, IGNITION, COMBUSTION, DETONATION, AND ARRESTING OF UNCONFINED AND CONFINED REACTIVE MIXTURES
R. EDSE, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (DF036640; AF-AFOSR-2511-73)

AF function - advanced chemical weapons, weapon delivery and defense, close air support, aircraft component vulnerability and survivability. Deficiency - insufficient understanding of the basic mechanisms and dynamic processes of initiation, propagation, attenuation and quenching of blast waves, flames and detonations in reactive media and lack of realistic guidelines for predicting properties and blast damage potentials of unconfined homogeneous and heterogeneous explosions and effectiveness of flame/detonation quenching techniques. Objective -to formulate mathematical models realistically describing the mechanisms responsible for initiation and detonations in reactive media. How work contributes - will provide additional understanding of, and analytical models realistically describing initiation propagation, attenuation and quenching mechanisms of blast waves, flames and detonations in reactive media not now available, and will contribute to establishing realistic guidelines for developing unique high-power explosive devices and effective flame and detonation arrestors.

Fundamental mechanisms and processes of phenomena associated with initiation, propagation and arresting of flames and detonations in unconfined and confined reactive mixtures will be studied. Included will be study of (a) spontaneous detonative decomposition and high-intensity explosions of endothermic compounds (e.g., acetylene), (b) spontaneous ignition and detonations in unconfined powderized metal fuel - and cryogenic fuel-oxidizer mixtures, (c) initiation and propagation of flames and transition to detonation as a function of initial conditions (e.g., initial temperature, unburned gas density, initial flame volume), igniter energy and externally induced turbulence, (d) blast wave flame and detonation wave attenuation and quenching in static and flowing reactive mixtures including effects of flow velocity, geometry, material (heat conduction, catalyst, inert gas) and sudden expansion on the quenching process. Theoretical models and analytical relationships will be formulated describing the phenomena involved and correlated with experimental results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0052, AUXILIARY POWER UNIT (APU) LABORATORY
P.G. COLEGROVE, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF458270)

To develop and operate an in-house capability to test either contractually developed APU components or develop new APU concepts, to provide quick reaction response to requests for technical assistance and problem solution from using Air Force organizations such as SPO's and other laboratories.

Build and maintain suitable laboratory facilities for conducting tests on APU components or concepts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0053, IMPROVED TEST APPARATUS AND ANALYSIS TECHNIQUES FOR BATTERY R&D
I.F. LUKE, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF455620)

The objective of this effort is to provide the additional major equipments and support items to the AFAPL battery facility as deemed necessary and consistent with justified planned experimentations to be conducted within the said facility. Also perform various minor tests/experiments which are not appropriate for complete individual work unit documentation.

Methodology employed for implementing the facilities/apparatus requirements include: (1) definition of the functional requirements of facilities/apparatus, (2) definition of hardware and physical arrangement requirements, (3) evaluation of energy efficiency of proposed facilities/apparatus, (4) coordination of facility requirements with Technical Facilities Division, (5) internal construction and/or procurement of defined apparatus, and (6) calibration and maintenance through both internal and contracted efforts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0054, INSTRUMENTATION, FACILITIES AND TECHNIQUES FOR COLLECTING DYNAMICS AND LOADS DATA ON AIR FORCE WEAPON SYSTEMS
D.E. SEELY, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF140280)

The broad problem facing the Air Force is to decrease life cycle costs of current and future aerospace weapon systems. Knowledge of the actual and expected flight and dynamic loads environments is an essential requirement for the reduction of costs of Air Force weapon systems. The objective of this effort is to develop and improve sensors, instrumentation systems, facilities and techniques that are required for the collection and analysis of flight and dynamic loads data in an inexpensive, reliable and expeditious manner. This effort provides the equipment and facilities needed to collect and analyze the data required to validly define the loads environment of Air Force weapon systems. The data will provide the neccessities for identification, prediction, prevention and control of vibration, structural, dynamic, flutter and acoustical problem areas.

Evaluations, investigations, configurations, procurements, environmental tests and flight tests of various types of flight data acquisition systems, sensors and components will be performed to ensure compliance with accuracy, life, flight-worthiness, maintenance, size, performance, weight, reliability and safety requirements of loads data collection systems. Particular items of concern include multivoltage power supplies, integration circuits to increase dynamic range of dynamics data acquisition packages, detailed investigations of pcm techniques for dynamics data acquisition and investigations of magnetic bubble memories for use as a replacement for magnetic tape recorders. Future data acquisition requirements will be determined and appropriate instrumentation will be developed and procured. Improvement of facilities include technical evaluations of contractors reports, procurement of state-of-the-art shaker and shock test systems, an evaluation of a study contract let by ASD engineering to determine manning usage of existing facilities, and maintaining mobile facilities (vans). New vibration testing and analysis techniques will be studied in-house. Studies will include the purchasing or writing of required analysis computer in-house programs and conducting experimental programs to check current and proposed ground vibration techniques. Reports will be prepared presenting results and conclusions of the experimental programs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0055, MICROELECTRONIC DES/FAB
R.E. SETTLE, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF099500)

Custom thick-film microcircuits and custom printed wiring boards will be built in an IH facility. This in-house effort will help reduce the transition time between a technological achievement and prototype system demonstration and at the same time reducing the acquisition costs of prototype hybrid microcircuits and as-

sociated interconnects on a printed circuit board. Intimate knowledge of IC microelectronic materials is mandatory. This IH facility will provide a prototype fabrication and test bed for interconnection and packaging concepts applicable to advanced avionic systems. Also contractual achievements and progress in manufacturing technology, exploratory and advanced development areas will be evaluated and assistance given where needed.

The H/PWB facility in thick-film and multilayer PWB technologies and in etchback of thin films will be maintained in order to: (1) be a knowledgeable consultant as required, (2) keep aware of the state of the art and discern proprietary techniques from direct applications of materials and standard processing techniques, (3) provide prototypes for functional demonstrations, (4) meaningful direct R&D contractual efforts. Reliable production of hybrid and PWB assemblies suitable for AF systems depends on a set of process-dependent design rules and process controls which must be documented, reviewed and correlated with the desired results. The capability to evaluate processing techniques and process controls in microelectronic interconnection and packaging in hybrid and PWB technologies will be established and maintained. Consultation, technical direction and deliverables evaluation will be accomplished relative to the following programs in the exploratory development and manufacturing technology areas: 1) AFALS 'high-density low-cost microelectronics packaging' 2) AFMLS 'manufacturing technology for hermetic chip carrier packaging', and 3) AFMLS 'establish improved manufacturing processes for polymide printed circuit boards.'

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0056, ACTIVE COOLING CONCEPTS FOR REENTRY FLIGHT VEHICLES

K.E. YELMGREN, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF138590)

To increase the performance of advanced missiles, improved heat protection systems are necessary. Active cooling is one method of alleviating the high heat loads of advanced reentry vehicles. The objective of this work unit is to investigate various methods for actively cooling components of reentry vehicles, such as nose tips and fins, in order to determine the most effective method. An effective active cooling method will allow steeper trajectories and a shape stable vehicle. This will result in less time for detection and counter measures, as well as increased accuracy.

Transpiration and gas jet cooling will be considered for the nose while the vortex cooling concept will be considered for the fins. Both analytical and experimental investigations will be carried out in order to determine the most efficient systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0057, ENGINEERING AND ANALYSIS SUPPORT OF SIMULATION STUDIES

W. HOVEY, Univ. of Dayton, Res. Inst., *Dayton, Ohio* 45409 (DF318330; F33615-77-C-0520)

To perform in-depth analyses on data collected in previous remotely piloted vehicle system simulation studies in order to arrive at a system configuration for which optimum performance can be expected.

Performance measures with certain desirable properties will be selected. These measures will be subjected to analytical methods which will give an indication at which points (or values) the system should be operated so as to optimize the performance of the total system. These analyses are over and above those done previously on the data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

4.0058, ANALYSIS OF INVENTORY/RESUPPLY SUBSYSTEM MODELS IN OPTIMAL MATERIEL DISTRIBUTION SYSTEM DESIGN

A.Z. KOVACS, Univ. of Dayton, School of Engineering, *Dayton, Ohio* 45409 (DF047590; AF-AFOSR-3266-77)

AF function - to design an effective air-freight transportation system in conjunction with an optimal inventory system to deliver spare parts and other high-priority equipment. Deficiency - the large number of commodities, air bases, types of cargo-aircraft, possible levels of inventory for each item at each logistics center make the optimization problem virtually impossible to solve in its entirety. Objective - to treat the inventory part of the problem separately and to inquire into ways to evaluate the effects of possible tradeoffs between money invested in larger inventories and in more elaborate transportation arrangements. How work contributes - the research to be performed has the potential for saving the USAF large sums of money for the same performance in the logistics area, or increased performance for the same monetary outlay.

The plan is to examine various queueing models for the inventory part of the AFLC set-up to see which are the most important factors in the trade-off problem involving transportation and inventories.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0059, SCIENTIFIC INVESTIGATIONS IN SUPPORT OF THE SPACE TELESCOPE PROJECT, TO ASSURE THAT THE SPACE TELESCOPE WILL PERFORM ASTROMETRIC FUNCTIONS

W.H. JEFFERYS, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (NAS 8-32906)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0060, SCIENTIFIC INVESTIGATION IN SUPPORT OF THE SPACE TELESCOPE PROJECT

D.L. LAMBERT, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (NAS 8-32905)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0061, ATMOSPHERIC TURBULENCE EFFECTS ON THE TEMPORAL-SPECTRAL DENSITIES OF OPTICAL SIGNALS 12867-GS

J. SMITH, Univ. of Texas, School of Engineering, *El Paso, Texas* 79999 (DA0H5579; DAHC04-75-G-0102)

To develop models for optical crosswind systems to describe the temporal spectral densities of remote scenes viewed through a turbulent atmosphere. Relevance - atmospheric turbulence effects over different ranges is important in several laser propagation systems being developed or currently used in the Army. ASL is particularly interested in turbulence effects in the laser remote sensing crosswind measurement system under development for use in the main battle tank. 'The program could be relevant and important for laser weapon systems or systems employing laser guidance' (MICOM). 'The resolution of the effects of saturation is fundamental to the application of this scheme (optical measurement of wind) under many turbulence-path-length conditions.' (BRL).

Simultaneous measurements yielding the spectral densities obtaining from intensity and angle of arrival fluctuations of remote scenes and of beams from coherent sources will be made over 0.5 km and 2.0 km horizontal paths during periods of strong and weak turbulence and a variety of wind conditions. The spectral characteristics will be compared with in-situ measurements of related meteorological parameters to check the validity of the model predictions. Upon establishment of the expected spectral characteristics, spatial and temporal filters will be used to obtain wind profiles along the path.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0062, THREE-DIMENSIONAL DISTURBANCES IN HIGH-SPEED BOUNDARY LAYER FLOWS
G.R. INGER, Virginia Poly. Inst. & St. U., School of Engineering, *Blacksburg, Virginia* 24061 (DF045690; F49620-76-C-0013)

AF function - advanced aerospace vehicles. Opportunity - provide better understanding of the mechanism of flow separation/reattachment and three-dimensional effects on pressure distribution, skin friction and heat transfer effects. Objective - investigate the twin problems of flow separation/reattachment and three-dimensional effects in high-speed boundary layer flows along two-dimensional and axisymmetric bodies. How work contributes - better understanding of this phenomenon will be directly applicable to the design of future aerospace vehicles.

A theoretical study will be established with the objective of developing a fundamentally sound yet engineering-oriented analytical approach from which skin friction, heat transfer, and wave drag can be predicted as function of Mach and Reynolds number, wall temperature ratio and vortex parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0063, THEORETICAL STUDIES OF SHOCK-BOUNDARY LAYER INTERACTIONS
G.R. INGER, Virginia Poly. Inst. & St. U., School of Engineering, *Blacksburg, Virginia* 24061 (DN223075; N00014-75-C-0456)

The performance of aircraft at transonic speeds, particularly during maneuvering, is severely limited by shock-boundary layer interaction phenomena which adversely affect the flow over the upper surfaces of the wings. In this study, an analytical attempt will be made to describe the interaction of a shock wave with a non-uniform stream--the non-uniformity being characteristic of either a laminar or turbulent boundary layer.

Though shock-boundary layer interaction phenomena are extremely important from an aircraft design and performance viewpoint, relatively little theoretical research has been devoted to this problem because of the inherent mathematical difficulties. In this task the flow field will be divided into four regions: one characteristic of the shock in the extreme outer portion of the boundary layer; a second characteristic of the viscous flow centered about Mach number one in the interior of the boundary layer; a third region of non-uniform but inviscid flow extending inward towards the wall; and a fourth region, viscous in nature, very close to the wall. The four regions will be combined to determine a uniformly valid description of the entire region.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0064, SUBSONIC AERODYNAMIC LOADS ON MISSILES 13164-E
A.H. NAYFEH, Virginia Poly. Inst. & St. U., School of Engineering, *Blacksburg, Virginia* 24061 (DA0Q5576; DAAG29 76 G0034)

To utilize discrete-vortex techniques to treat the subsonic aerodynamic interactions between the components of missile-like configurations. The design programs at MICOM for most missiles and rockets would benefit from this research program. Two major thrust areas, free-flight rocket program and terminal homing program, would be particularly benefitted. At BRL, the proposed work would be applicable to the flow about the tail fins of low-velocity mortars.

The discrete-vortex technique will be extended to interactions of wings having arbitrary planforms, positions, and orientation as well as to wing-body interactions. Quantitative comparisons with experimental data will determine the accuracy of the predicted interactions effects.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0065, UNSTEADY TURBULENT BOUNDARY LAYERS AND SEPARATION
D.P. TELIONIS, Virginia Poly. Inst. & St. U., School of Engineering, *Blacksburg, Virginia* 24061 (DF038350; AF-AFOSR-2651-74)

AF function - advanced turbomachinery. Opportunity - provide analytical techniques for predicting stall, flutter and surge in compressor stages. Objective - the formulation of a numerical scheme of calculating unsteady turbulent boundary layers with particular emphasis on steady and unsteady separation. How work contributes - viscous phenomena and separation in cascade flow governs the location and shape of the wake and thus the phenomena of stall, surge and flutter. Understanding and formulation of analytical method to predict stall, surge, and flutter will enable engine designers to predict engine performance without need for extensive testing.

Efforts have been directed towards development of reliable methods for calculating flow in turbomachinery. These methods will be combined with various turbulence models in order to study unsteady flow around a cascade. Results will be compared with experimental data. Different closure assumptions will also be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0066, AN INVESTIGATION OF SEMICONDUCTOR ELECTRODES
A.M. BUONCRISTIANI, Coll. of William & Mary, Undergraduate School, *Newport News, Virginia* 23606 (NSG 1514)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0067, A NUMERICAL INVESTIGATION OF VISCOUS SLOT FLOW
C.H. COOKE, Old Dominion University, School of Engineering, *Norfolk, Virginia* 23508 (NSG 1517)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0068, PHOTOELASTIC STUDIES OF ADVANCED LAP JOINT CONCEPT
M.W. HYER, Old Dominion University, School of Engineering, *Norfolk, Virginia* 23508 (NSG 1507)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0069, OUTPUT FEEDBACK SYNTHESIS FOR STOCHASTIC MULTIVARIABLE SYSTEMS
S.R. LIBERTY, Old Dominion University, Graduate School, *Norfolk, Virginia* 23508 (NSG 1519)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, DEVELOP A REENTRY DESIGN HANDBOOK
J.V. MCANALLY, Remtech Incorporated, *Huntsville, Alabama* 35805 (DF248420; F19628-77-C-0022)

AF function - recovery of aerospace payloads. Deficiency - class A recovery of large-diameter, short-length research rocket payloads from exoatmospheric altitudes. Objective - develop a reentry handbook to assist payload integration engineers in evaluating suitability of configuration designs for acceptable reentry and recovery criteria. How research contributes - will result in improved reliability of payload recovery by supplying the integration engineer with definitive reentry design guidelines at the payload design stage.

Through literature search, analytical analysis and/or scale model testing develop a reentry design handbook for evaluating the suitability of large-diameter, short-length payload configurations for acceptable reentry and recovery criteria. Pertinent raw data should be developed for the following range of input parameters: both pure cylinder and cylinder with 30 degree included angle conical forward end configurations - body diameters from 22 inch to 38 inch - fineness ratio from 2.0 to 5.0 - center of gravity location of plus or minus 10 percent of body length about the geometric center of volume. Reentry velocity equivalent to that resulting from free fall from apogees from 100 to 350 statute miles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0002, REMOTE SENSING OF SO2 EFFECTS ON VEGETATION

C.D. SAPP, U.S. Tennessee Valley Auth., Div. of Environ. Planning, *Sheffield, Alabama* 35660 (D6-E721-DJ; V625C-45)

This research activity involves testing, refinement, and development of remote sensing instrumentation and techniques for monitoring the visible effects of SO2 emissions from fossil-fueled electric generating stations on terrestrial vegetation. NASA is collaborating with TVA in the project. Low- and high-altitude color, color infrared, multi-spectral scanning, and other types of imagery and ground-truth data are being obtained for effects on soybeans and mixed southern pine-deciduous hardwood timber stands in the vicinities of the Shawnee, Widows Creek, Johnsonville, and Colbert Steam Plants for both manual and automated interpretations.

Milestone report due December 1978.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Energy Minerals & Industry

5.0003, WATER QUALITY MAPPING AND LOCATION OF ENTRAPMENT ZONE IN SAN FRANCISCO BAY DELTA

R.N. COLWELL, Univ. of California, School of Agriculture, *Berkeley, California* 94720 (NSG 5256)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0004, SUPERCOOL STRATUS DISPERSAL

C. WISNER, North Amer. Weather Consult., *Goleta, California* 93017 (DF247730; F19628-76-C-0306)

AF function - military weather modification. Deficiency - inability to disperse stratus. Development - optimize the technique for dispersing supercooled stratus clouds. How development contributes - provides a means to disperse supercooled stratus in support of tactical close air support missions of the Air Force. This study will evaluate delivery tactics, clearing area size potential and techniques of targeting clearing area over a predesignated target.

Supercooled stratus dispersal tests will be conducted using silver iodide as the seeding material. Tests will concentrate on the ability to target the clearing over a predetermined ground target. Silver iodide will be dispensed from a small aircraft. Winds will be determined using the aircraft navigational system, and the seeding will be done at the appropriate position upwind of the target. Airborne photographic documentation of the stratus clearing will be acquired. The contractor will choose the test site which will be based on stratus frequency, the volume of air traffic, and state laws concerning weather modification.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0005, EARTH DYNAMICS ANALYSES

W.M. KAULA, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (NSG 5263)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0006, TRACKING AND MONITORING OF HURRICANES BY HF SKYWAVE RADAR OVER THE GULF OF MEXICO

J.W. MARESCA, S R I International, *Menlo Park, California* 94025 (DF044800; F49620-76-C-0023)

AF function - the Air Weather Service has a technical need for remote measurement of tropical cyclone parameters. Deficiency - in the early developing stages of a tropical cyclone, the center of the cyclone, as determined by satellite data, can be displaced from the surface center by as much as 100 nautical miles. At nighttime, the coarser resolution of the satellite IR sensor present problems in locating the tropical cyclone. Objective - HF radar technology will be used for remote sensing of the sea surface conditions and surface winds in tropical cyclones. Contribution - the availability of a remote wind sensing capability with OTH radar will permit a significant reduction of the weather reconnaissance flights with little or no degradation of the present existing forecast capability. This will be a cost-effective measure.

The SRI radar (OTH) will be used as an active radar. The tropical storm area will be eluminated by a beam of radio waves originating at this radar transmitting site, and the radio waves reflected (backscatter) from the storm area are detected by a highly directional antenna located at the radar receiving site. The recorded backscatter data will be analyzed to track and monitor hurricanes to determine the sea state and surface winds.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0007, STOCHASTIC MODELING OF TIME-AVERAGED EQUATIONS FOR CLIMATE DYNAMICS

J.R. SPREITER, Stanford University, School of Engineering, *Palo Alto, California* 94305 (NSG 5254)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0008, EPHEMERIDES SYSTEM APPLICATION

K. BHAVNANI, Logicon Incorporated, *Torrance, California* 90503 (DF248150; F19628-76-C-0304)

AF function - ephemerides systems applications for research on physics of upper atmosphere. Deficiency - requirement for continual modification and maintenance at state-of-the-art level for current vehicles of interest and any future launches. Objective - advancement and improvement in orbital parameter accuracies as required by researchers investigating experimental results. How research contributes - determination of atmospheric effects, e.g., density of atmosphere, atmospheric drag on a vehicle, geomagnetic effects during periods of high, medium and low solar activity, as well as improvements in earth modelling and continuing investigations of auroral zone data.

Provide analysis of experimental data from the upper atmosphere utilizing specialized methods of analysis to perform atmospheric modelling using spectral analysis, statistical analysis and other numerical methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0009, GATE RAIN ATLAS

W.L. WOODLEY, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (85221211)

PROJECT OBJECTIVE: To produce a rainfall atlas of the tropical Atlantic Ocean during the period of the Global Atmospheric Research Project's Atlantic Tropical Experiment.

CURRENT YEAR PLAN: Production runs nf technique on the NOAA CDC 6600 in Boulder.

PROGRESS REPORT: Computerization of the rain estimation technique which employs geosynchronous satellite data has been accomplished.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0010, NUMERICAL SIMULATION OF VERTICAL TEMPERATURE PROFILE RADIOMETER (VTPR) TEMPERATURE RETRIEVALS IN A SEVERE STORM ENVIRONMENT
T.H. VONDERHAAR, Colorado State University, School of Engineering, *Fort Collins, Colorado* 80523 (NSG 5259)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0011, TROPICAL CYCLONE INTENSITIES FROM SATELLITE MICROWAVE DATA
T.H. VONDERHAAR, Colorado State University, School of Engineering, *Fort Collins, Colorado* 80523 (NSG 5258)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0012, MATHEMATICAL AND PHYSICAL SCIENCES COMMITTEE ON SOLAR-TERRESTRIAL RESEARCH PANEL ON THE INTERNATIONAL MAGNETOSPHERE STUDY (ABBREV)
E.R. DYER, Natl. Acad. of Sciences, *Washington, District of Columbia* 20037 (ATM77-20109; C310-370)

The National Academy of Sciences-National Research Council, in behalf of its Panel on the International Magnetospheric Study (IMS) of its Committee on Solar-Terrestrial Research (CSTR), one of the constituent bodies of the NAS-NRC Geophysics Research Board, will organize and run an IMS Working Conference.

The purpose of the IMS Working Conference is to plan ways to enhance the scientific return from the research activities associated with the U.S. part of the IMS program. The conference will take place in the fall of 1977, to lay the groundwork for subsequent workshops on the major subtopics of magnetospheric physics. These workshops would be held beginning in 1978, after the launch of the International Sun-Earth Explorer (ISEE A/B) pair of spacecraft, (now scheduled for mid-October 1977) and initial data acquisition period for those spacecraft. The product of the IMS Conference will be a written report which will include summaries of the outstanding scientific questions in each area, the available and expected IMS coordinated data, and a research plan which can focus the attention of the entire IMS community on the means available to attack the central scientific issues. This report will be disseminated to the IMS community at large.

A subcommittee of the Panel for the IMS (under the chairmanship of Dr. Coroniti, UCLA) will plan the details of the IMS Working Conference.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0013, FLORIDA WATER RESOURCES MANAGEMENT SYSTEM USING REMOTE SENSING AND AUTOMATIC DATA PROCESSING
J.F. BARTHOLIC, State University of Fla. Sys., Inst. of Food & Agric. Sci., *Gainesville, Florida* 32601 (NAS 10-9348)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0014, DIGITAL PROCESSING OF LANDSAT MSS AND TOPOGRAPHIC DATA TO IMPROVE CAPABILITIES FOR COMPUTERIZED MAPPING OF FOREST COVER TYPES
R.M. HOFFER, Purdue University, School of Agriculture, *Lafayette, Indiana* 47907 (NAS 9-15508)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0015, EARTH RESOURCES DATA PROCESSING REMOTE TERMINAL SUPPORT
UNKNOWN, Purdue University, Graduate School, *Lafayette, Indiana* 47907 (NAS 5-24462)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0016, DEVELOP A DATA BASE CLASSIFICATION SYSTEM FOR DETERMINING THE REHABILITATION POTENTIALS OF SURFACE MINED LANDS
A.T. JOYCE, U.S. Natl. Aero. & Space Adm., Earth Resources Laboratory, *Slidell, Louisiana* 70548 (D5-E771; V625C-17)

OBJECTIVE: Develop a procedure which utilizes both Landsat and ancillary data in such a manner that a classification of various rehabilitation potentials can be made. Ancillary data relates to soil type, slope, aspect, rainfall, elevation, temperature, and evaporation not directly associated with the Landsat data, but nonetheless considered as being of significant importance to the overall effectiveness of the rehabilitation classification procedure devised.

TECHNICAL APPROACH: Derive land cover information from Landsat digital data using standard Landsat computer implemented techniques. All information will be integrated into a Data Base file specifically constructed for the 1 degree by 1 degree Campbell Co., WY study area. All parameters will then be utilized by specific applications software to estimate the rehabilitation potential for sites within the study area. An hierarchical scheme is to be developed which can be used as an indicator of rehabilitation potential.

PROGRESS: Digitization of ancillary parameters underway, Landsat digital data located and acquisition is in progress, ground truth at time of satellite overpass complete. 06/78 Final Report.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Energy Minerals & Industry

5.0017, STUDY OF OCEAN FINE STRUCTURES
O.M. PHILLIPS, Johns Hopkins University, School of Arts & Sciences, *Baltimore, Maryland* 21218 (NAS 6-2888)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0018, GLOBAL SCINTILLATION STUDIES
J. AARONS, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF244780)

AF function - communications. Deficiency - inadequate knowledge on the transmission of radio waves. Research - investigate ionospheric perturbations caused by solar geophysical phenomena. How research contributes - improves reliability and accuracy of satellite communication and navigation system. The objective is to study the physical and radio propagation characteristics of radio star and satellite signals being transmitted through the atmsophere and the relation of these characteristics to the reliability and accuracy of satellite communications systems. In FY-75 multifrequency data will be obtained at auroral and equatorial latitudes to supplement the existing data base comprised mainly of VHF (136 mHz) data in order to determine the frequency dependence of scintillations.

By studying the variations of amplitude and polarization of radio waves traversing the ionosphere, the processes which produce both the normal electron density profile and f-layer irregularities can be understood. Multi-station measurements permit latitudinal variations to be compared from the equator to the polar regions using transmissions from synchronous satellites. A comprehensive evaluation of the effects of the aurora, magnetic storms, particle precipitation and sunspot cycle on radio wave propagation through the ionosphere will allow the preparation of synoptic data for system designers. The results are used to determine the effects of amplitude scintillation on communications from synchronous satellites. Previously this work unit formed a part of the effort covered under 46430101.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0019, IMPROVED 10 CM WAVELENGTH WEATHER RADAR

A.W. BISHOP, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249230)

AF function - navigation and detection functions of the strategic, tactical, air defense, and airlift forces. Deficiency - detection capability of weather radar systems in current use is insufficient to detect and identify hazardous zones in storm systems. Objective -develop a 10 cm weather radar with improved characteristics and capabilities. How development contributes - an improved 10 cm weather radar system provides increased detection capabilities, increased detection range and greater reliability of operation for the detection and identification of storm systems.

This in-house effort is concerned with the design and development of an improved weather radar system having characteristics comparable to specifications contained in Air Weather Service ROC for an advanced weather radar.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, PCM TELEMETRY AND CC FOR BALLOONS

A.A. GIANNETTI, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF248870)

AF function - advance balloon systems (surveillance, reconnaissance, communications, environmental research support). Deficiency - existing instrumentation systems do not meet control and telemetry requirements for proper evaluation of AF payloads. Objectives - design, develop, and test hardware and software for balloon PCM flight systems to provide real time data decommutation and manipulation through the use of a minicomputer. How research contributes - the new instrumentation will provide the necessary accuracy and format for the proper logging and display of vital scientific data essential for proper evaluation of AF scientific balloon-borne payloads.

An existing PDP11/40 computer will be interfaced with a PCM ground station and a software program will be developed for data handling, logging and manipulation. An airborne PCM system will be developed in-house to meet most scientific technical requirements and used to verify and evaluate the overall system capability. A contract will be utilized to support this work, both for component fabrication and for interface, installation and software development.

SUPPORTED BY U.S. Dept: of Defense, Air Force, Geophysics Lab.

5.0021, RADIATION TRANSPORT

J.I. KING, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF244210)

AF function - deleterious effects on stratosphere resulting from B1 flight operations. Deficiency or opportunity - pollutant exhaust gases can trigger kinetic reactions which deplete stratospheric ozone shield which in turn affects atmospheric radiative heat balance. Objective -to model the environmental impact of high-altitude aircraft on the stratospheric heat balance. How research contributes - makes possible impact assessment of system and suggests methods of minimizing harmful effects.

Formulation of a radiation transport model for the naturally-occurring, optically active molecules which reproduces the main features of the stratospheric thermal profile, 2) study of radiation effects caused by chemical and aerosol additives to the stratosphere, and 3) investigation of the coupling of the stratospheric thermal regime to the dynamics of tropospheric general circulation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, DISTURBED POLAR IONOSPHERIC MODEL

R. NARCISI, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249370)

AF function - maintain effective command and control of Air force units during periods of a naturally or nuclearly disturbed atmosphere. Opportunity - models can be developed to provide inputs for system computer codes to provide survivable communication modes in nuclear scenarios. Objective - formulate polar models for geomagnetically disturbed conditions, daytime auroral absorption events and to define sources of travelling ionospheric disturbances (TID's). How research contributes - models to predict RF blackout in polar daytime absorption events, predict onset of TID's from indices of geomagnetic activity, and propagation survivability of VLF to SHF frequencies will be provided for inputs to AF, DNA and DCA codes.

Ion and neutral chemical processes, transport processes, solar and energetic particle ionization, excitation and dissociation processes are used in various calculations to model the flight measurements. This leads to a determination of the important processes required to predict atmospheric-ionospheric behavior. The results are then made available either for direct use by AF systems or for AF systems computer code development programs. The excellent results from the AF S3-1 and S3-2 neutral and ion composition measurements will be used to modify and update a model of the neutral and ionospheric structure during normal and geomagnetically disturbed conditions. Data from exercise aeolus, detailing the polar ionospheric structure and dynamics during an enhanced auroral electrojet, quiescent conditions and an auroral arc will be used.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, LOW-ALTITUDE SPACECRAFT CHARGING ANALYSIS

M. SMIDDY, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249060)

AF function - surveillance, communication, magnetospheric modelling and spacecraft charging. Deficiency - inadequate knowledge of space vehicle interaction with its environment and all factors influencing charging. Objective - to use existing data to study charging effects at low altitudes. How research contributes - permits improved military space vehicle design for communication and surveillance systems, provides solution of spacecraft charging problems.

Experimental data, already in-house, from instruments flown on S3-2 and Injun V polar orbiting satellites will be examined to determine environmental and surface material factors which influence vehicle charging.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, LARGE-SCALE OPTICAL MAPPING OF THE IONOSPHERE

E.J. WEBER, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249790)

AF function - communications and detection. Deficiency - understanding effects of both precipitating particle and non-particle produced ionospheric disturbances on communications at high and equatorial magnetic latitudes. Objective - investigate ionospheric disturbance phenomena by observation of auroral emission features measured with a sensitive imaging system. How research contributes - the disturbed ionospheric environment affects AF ground, airborne and satellite communications and radar systems. The contribution is a better understanding of dynamic ionospheric-magnetospheric processes through measurement and analysis of associated optical emissions, and better specification of ionospheric disturbances to communication satellite SPO's and DMSP, especially during times of coordinated test programs.

High time resolution measurements of auroral optical emissions, with large spatial coverage, will be coordinated with other simultaneous geophysical measurements from the AFCRL Airborne Ionospheric Observatory, NKC-135 aircraft no. 53131, and from selected ground stations and satellites to provide a means of assessing ionospheric response to magnetospheric substorms over sub-auroral, auroral and polar cap regions. Characteristics of precipitation particles will be derived from the optical measurements and these, together with ionosonde measurements, will be used to study the behavior of the ionospheric e and f regions. Disturbance phenomena such as sudden auroral activations or irregular structures will be well documented to allow direct comparison of the effect of these features on AF systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, 4CM SOLAR RADIO FLARE FORECAST STUDY
M.D. PAPAGIANNIS, Boston University, Graduate School, *Boston, Massachusetts* 02215 (DF250920; F19628-76-C-0027)

AF function - communications and navigation. Deficiency - medium-range (1 to 7 days) and short-range (min. to 1 day) capability for advance and reliable predictions of operationally significant solar emissions. Objective - to detect signatures in active region radio emissions that warn of impending solar activity. How research contributes - develops techniques that allow advance warning of solar eruptions, whose electromagnetic and particle emissions disrupt HF communications, the polar ionosphere, and satellite sensors. Provides knowledge of the development of active regions necessary to establishing long-range forecasts (7 to 45 days) of the centimeter radio fluxes used in atmospheric density models for satellite navigation.

Solar active regions will be tracked with the high-resolution NEROC 120-foot haystack radio telescope operating at 3.8 cm wavelength. Variations in polarization and brightness temperature of the emission from the regions that forewarn of solar activity will be sought. Polarization changes during the flare events will be analyzed to determine the magnetic and plasma effects that determine the magnitude of electromagnetic and particle emission escaping from the active region out into the space environment.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, SOLAR WIND ANALYSIS
H.S. BRIDGES, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (DF245450; F19628-75-C-0131)

AF function - communications, surveillance and satellite operations. Deficiency - incomplete knowledge of processes connecting solar phenomena with upper atmosphere and near-earth environment. Objective - define the prevailing processes and develop prediction schemes. How research contributes - relating solar wind and observed energetic particle fluxes observed by satellite with terrestrial and/or near-earth operational problems leads to understanding of problem and ultimate solution.

Solar wind data from the satellites Solrad 11 will be obtained from the naval research laboratories and compared with other Solrad data, particularly AFCRL proton sensors. These will be compared with each other and with observations from ground sources and other satellites. These results will contribute to our understanding of the phenomena.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, GEOPHYSICAL STUDY OF THE STRUCTURE AND PROCESSES OF THE CONTINENTAL CONVERGENCE ZONES
P. MOLNAR, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (NSG 5260)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0028, RESEARCH OF GRAVITY FIELD OVER THE INDIAN OCEAN
J.G. SCLATER, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (NSG 5253)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0029, DATA ANALYSIS OF THE ORBITER RADAR MAPPER
UNKNOWN, Mass. Inst. of Technology, Graduate School, *Cambridge, Massachusetts* 02139 (NAS 2-9483)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0030, CHEMICAL PERTURBED STRATOSPHERE
N.D. SZE, Environmental Res. & Tec. Inc., *Concord, Massachusetts* 01742 (DF248850; F19628-77-C-0078)

AF function - environmental effects of Air Force systems operations in the stratosphere. Objective - to determine the effects of perturbations in the natural stratosphere - troposphere caused by the exhaust emissions from Air Force vehicle operations. How research contributes - provide the Air Force with information on the degree of environmental modifications by its systems operations which will prevent, by arbitrary decision, restrictions and delays on its missions.

Develop a new model which will couple radiative transport to chemistry and dynamics to provide a more complete description of environmental effects of injected pollutants.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0031, PULSE PAIR PROCESSING TECHNIQUES FOR IDENTIFICATION OF SEVERE STORMS
UNKNOWN, Environmental Res. & Tec. Inc., *Concord, Massachusetts* 01742 (DF246910; F19628-76-C-0264)

AF function - protection of aerospace systems in severe storms. Deficiency - identification and warning of storm hazards by current methods are unreliable. Development - develop radar techniques for diagnosis of storms and attendant precipitation and wind fields. How development contributes - provides improved identification and prediction of convective storm hazards. Measurements of shear anomalies and reflectivity structure provide data for identification of severe convective storms and for study of storm organization and trend as revealed by interaction of fields of motion and precipitation.

Identify and evaluate radar techniques for the identification and prediction of severe storms by utilization of the velocity spectral moments generated by the AFGL pulse pair processor and improved techniques for applying radar reflectivity data. Implement promising techniques furnishing computer programs, tests and evaluations and complete program documentation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0032, AURORAL OPTICAL STUDY
R.H. EATHER, Keo Consultants, *Newton, Massachusetts* (DF248640; F19628-77-C-0097)

AF function - communications and detection. Deficiency - understanding effects both of precipitating particle and non-particle produced ionospheric disturbances which degrade communications at high and equatorial magnetic latitudes. Objective - investigate ionospheric disturbance phenomena by means of auroral spectral emission features measured with a sensitive T.V. system. How research contributes -provides a new and powerful technique for large-scale and high time resolution auroral measurements. Coordination with other simultaneous measurements from the AFGL Airborne Ionospheric Observatory, NKC-135 aircraft, number 53131, will allow comprehensive measurements of ionospheric response to substorms over sub-auroral, auroral and polar cap domains.

Perform comprehensive investigation of the latitude and local time behavior of large-scale ionospheric disturbance phenomena resulting from auroral particle precipitation in the vicinity of the auroral oval. This investigation will be based primarily on ground and airborne all-sky imaging photometer, all-sky camera and meridian scanning photometer auroral measurements. Investigate the dynamic properties of the equatorial f-region and the formation of ionospheric irregularities through associated airglow signatures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0033, DESIGN AND FABRICATE
F.B. SELLERS, Panametrics Incorporated, *Waltham, Massachusetts* 02154 (DF242880; F19628-74-C-0217)

AF function - communications and reconnaissance. Deficiency -unknown cause of erratic system performance. Research - develop instrument to measure electron and proton fluxes in .05-300 keV energy range. How research contributes - this instrument will be used in the scatha satellite as one of a number of sensors intended to define the particle and field environment at synchronous orbit and its effect on satellite performance. It involves the design and testing of feasibility models and the fabrication of flight instruments and associated GSE. Instrument will feature maximization of information and minimization of weight, power requirements and telemetry demands.

The rapid-scan instruments designed for the Scatha satellite must be shielded against energetic electrons. Appropriate electronic components are to be shielded as well as experimental testing of the detector response to background.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0034, STUDY OF LOCAL STORM CONVECTION
H.E. FUELBERG, St. Louis University, Graduate School, *St. Louis, Missouri* 63103 (NAS 8-32838)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0035, NAVY ENVIRONMENT - ANALYSIS AND MODELING OF SEA ICE CHARACTERISTICS IN THE ARCTIC USING SATELLITE IMAGERY
W.D. HIBLER, U.S. Army, Cold Reg. Res. & Engin. Lab., *Hanover, New Hampshire* 03755 (DN675489; N00014-77-MP-70003)

To develop analytic techniques of remotely sensed data and to develop models and to increase knowledge of the environmental factors affecting the motions and state of sea ice. Prediction of the environment for the benefit of surface and undersea operations is a goal of the arctic program.

The contractor will continue to develop, refine and test the viscous model with special emphasis on the ice edge situation, and examine coupling mechanisms between the sea ice and atmospheric and oceanic circulation. A primary objective in the program, the data set of ice edge position and ice motion in the Beaufort Sea, will be constructed from various sources of data for the years 1973-1976. Certain meteorological parameters will also be gridded in the same fashion, allowing the addition to predictions by the viscous model, correlations between local and regional winds and ice deformation. An additional major objective of this program is to gain some understanding of the effects that sea ice dynamics and changes in ice extent have on oceanic and atmospheric circulation models.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0036, SOLAR PRESSURE ACCELEROMETER STUDY
M.A. MELDRUM, Textron Incorporated, *Buffalo, New York* 14205 (DF249540; F19628-77-C-0160)

AF function - airborne navigation, tracking. Deficiency - effect of solar radiation pressure on satellite orbits cannot be predicted with sufficient accuracy. Objective - direct solar pressure measurements with satellite-borne accelerometers. How research contributes - permits accurate determination of Air Force satellite ephemerides.

An electrostatic accelerometer will be flown on the navigation technology satellite NTS-3 for the purpose of accurately measuring solar radiation pressure acting on the spacecraft. An analytical study will be performed to relate the MESA accelerometer capabilities to the specific orbital acceleration environment of NTS-3. The results of this study will be an experiment design which will permit high-accuracy solar pressure measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0037, USE OF NUMERICAL CONTINENTAL SHELF CIRCULATION AND POLLUTANT TRANSPORT MODELS FOR ANALYSIS OF REMOTELY SENSED DATA
M.L. SPAULDING, Univ. of Rhode Island, School of Engineering, *Wakefield, Rhode Island* 02881 (NSG 1495)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0038, PETROLOGIC STUDIES OF METEORITE GROUPS
H.Y. MCSWEEN, Univ. of Tennessee, Graduate School, *Knoxville, Tennessee* 37916 (NSG 7413)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0039, WIND REGIME OF VARIOUS DUNE TYPES IN THE SOUTHEASTERN CALIFORNIA DESERT
R.S. SMITH, Univ. of Houston, School of Arts & Sciences, *Houston, Texas* 77004 (NSG 7410)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0040, ALASKAN INCOHERENT SCATTER RADAR INVESTIGATIONS OF THE HIGH LATITUDE IONOSPHERE
J.R. DOUPNIK, Utah Higher Education System, Center for Res. in Aeronomy, *Logan, Utah* 84321 (ATM76-17334 A02)

This grant continues experimental investigations of magnetospheric convection in the auroral zone and its effects on the ionosphere using data obtained from the Chatanika, Alaska, incoherent-scatter radar system. The primary objectives are studies of the properties of the convection electric field in the auroral oval together with the related geophysical quantities such as electron density profiles, electrical conductivities and currents, neutral winds in the E region, and atmospheric heating rates due to ion-neutral friction and to precipitating energetic particles. A series of radar measurements will be made to investigate a number of specific aspects of the electric field; its spatial structure over very large areas in the polar cusp region, at the boundary between the auroral oval and the polar cap and in the main electron trough region. Similarly, other experiments will be made to investigate the formation of the trough in relation to the several theoretical mechanisms. Several cooperative experiments are proposed with instruments aboard the Triad, ISIS, and AE-D satellites and with a prospective series of balloon-launched packages in Alaska; in these experiments this grant would support acquisition of the Chatanika radar data.

The above experiments are ideally suited to the aims of the International Magnetospheric Study.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0041, RADIATIVE TRANSFER MODELS FOR THE EARTH RADIATION BUDGET AND CLIMATIC STUDIES
S.N. TIWARI, Old Dominion University, School of Engineering, *Norfolk, Virginia* 23508 (NSG 1522)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0042, INVESTIGATION OF COMPUTER PROCESSING METHOD OF MULTIPLE GEOSTATIONARY SATELLITE TRANSMISSIONS FOR CLOUD HEIGHT DETERMINATION
V.E. SUOMI, Univ. of Wisconsin, School of Letters & Science, *Madison, Wisconsin* 53706 (NSG 5251)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0043, STRATOSPHERIC CONSTITUENTS (PAM)
T.J. PEPIN, Univ. of Wyoming, School of Arts & Sciences, *Laramie, Wyoming* 82071 (DN223438; N00014-75-C-1180)

The objective of this research is to determine reference levels of aerosols in the stratosphere for the purpose of eventually determining the environmental impact of Navy high-performance aircraft on the stratosphere.

This research will involve a solar extinction experiment on a SAMSO satellite to determine globally, or hemispherically, the distribution of stratospheric aerosols. A device will be designed, constructed and flown on a STP satellite to measure solar extinction at various sunrise and sunset angles. The reserve instrument will be modified to become part of the DARPA experimental satellite to be launched in 1978. The resulting data will be processed to show monthly and seasonal values of particulate concentration in the stratosphere.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, FATIGUE EFFECTS UPON THE ACQUISITION OF FLYING SKILL
P.A. IRISH, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF222080)

The objective of this study is to quantitatively assess the effects of mission length upon learning piloting skills in simulated flight.

A contact mission profile will be developed and flown in ASUPT by student pilots prior to commencement of their flight training. This mission profile will consist of repeated practice in elementary aircraft control (i.e., pitch, power, and bank). These basic skills will be practiced by attempting straight and level, 30 degree bank turns, constant airspeed (CAS) climbs and descents. Five groups will fly this mission profile for five different time lengths, ranging from 25 to 125 minutes. A criterion maneuver will be presented to each student at the completion of this mission and automated performance measurements will be taken to determine the number of repetitions he requires to achieve a designated proficiency level in the criterion maneuver. The resultant data will be compared to provide estimates of the magnitude and distribution of learning decrement over time. Information provided by this research will be utilized in determining the length of student training missions flown in ASUPT. Full-time work is awaiting the availability of a suitable performance predictor test required by the research design. Efforts are currently underway in attempting to provide this item.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, OBJECTIVE FREQUENCY DOMAIN BASED PERFORMANCE MEASURES IN ASPT
E. MCDOWELL, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223530)

To develop a pilot performance measurement technique which is not maneuver specific and is sensitive to levels of pilot proficiency. The candidate measurement technique under consideration will record the frequency of movement of the aileron, elevator and throttle controls. It is anticipated that as pilots become more proficient they will change from high-frequency movement to low-frequency movement of these controls. A secondary objective is to compare the amount of information obtained with frequency-based measures with that from the conventional time-based measures of pilot performance. Frequency-based measures may prove to be more generalizable across various flight maneuvers. In addition, the development of frequency of movement profiles for pilots at various skill levels could be used in a simulator equipped with an automated measurement system to adjust the level of difficulty of the tasks being taught to the student.

A comparison will be made between various frequency domain measures and ASPT objective measurement profiles for selected maneuvers over a range of pilot experience levels. Data will be collected in ASPT on four tasks (straight and level, turns to headings, vertical s-delta, and formation flight) over four levels of T-37 flying experience (novice, mid-training, post T-37, and instructor pilot). Control inputs will be passed through filters of 2, 1, 1/2, 1/4, and 1/8 Hz for elevator, aileron, and throttle positions. There will be 10 subjects per group and two repetitions of each maneuver by each subject. If the results of the initial study are successful, future research will explore application to the measurement of skill maintenance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, PLATFORM MOTION REQUIREMENTS FOR INITIAL TRAINING OF AIR-TO-AIR COMBAT SKILLS
L.D. POHLMAN, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223230)

To determine the effectiveness of platform motion for the initial training of F4 air-to-air combat skills and to determine whether the onset cues provided by the synergistic six-post system on the simulator for air-to-air combat (SAAC) transfer of skills to performance in the aircraft.

The incremental training value of simulator platform motion will be determined through the application of a transfer of training paradigm. In the event that onset motion cuing has an incremental transfer effect, students training using platform motion should perform significantly better in the airplane than students trained without platform motion. To make this assessment, three groups are required: (1) students trained in the simulator who receive onset cuing provided by platform motion, (2) students trained in the simulator who do not receive onset platform motion cuing, and (3) students who do not receive any simulator training. The third group is necessary to establish that transfer from the simulator to the aircraft has occurred. The research effort will include the following tasks: (a) selection of air combat maneuvers where motion cues could play a vital role and the development of performance measures for those chosen, (b) development of a syllabus for training these fighter maneuvers, (c) evaluation of the effects of platform motion in terms of transfer of training to the aircraft using student pilots, and (d) evaluation of the effectiveness of the training provided.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0004, STUDIES OF POTENTIAL BIOLOGICAL COMPONENTS OF CLOSED LIFE SUPPORT SYSTEMS APPLICABLE TO LARGE SPACE HABITATS
J.M. PHILLIPS, Univ. of Arizona, Graduate School, *Tucson, Arizona* 85721 (NSG 2309)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0005, HISTOPATHOLOGICAL CHANGES IN RODENTS CAUSED BY HZE PARTICLE IRRADIATION
E.V. BENTON, Univ. of San Francisco, School of Science, *San Francisco, California* 94117 (NSG 2304)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0006, ISD APPLICATION STUDY
J.R. SWINK, Logicon Incorporated, *Torrance, California* 90503 (DF222790; F33615-77-C-0034)

To identify and document problem areas encountered in the application of ISD procedures to flying training programs and develop alternative plans for dealing with the problems so as to optimize implementation of Air Force ISD program.

This study will be conducted in five phases. In phase I the contractor will refine and add detail to the research plan

developed in the proposal. In phase II the contractor will visit operational ISD units to collect data related to successes and problems in the application of ISD methodology. Phase III (synthesis and analysis) will include a review and analysis of ISD documentation, categorization of problems and successes, identification of common and uncommon problem areas across commands, and a full and clear description of the problem. Phase IV will develop an array of alternative plans for solving the problems identified during phase III. In phase V, the contractor will submit a technical report to the entire study project to include a revised report of alternative solutions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0007, INFLUENCE OF WEIGHTLESSNESS ON BIOCHEMICAL AGING OF FLIGHT MUSCLE IN DROSOPHILA MELANOGASTER

M. ROCKSTEIN, Univ. of Miami, School of Medicine, *Miami, Florida* 33124 (NCA 2-438801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0008, RESEARCH ON SIMULATOR TRAINING EFFECTIVENESS

P.W. CARO, Seville Research Corporation, *Pensacola, Florida* 32505 (DF049310; F49620-77-C-0112)

AF function - modern flight simulators are complex physical systems that simulate other complex physical systems such as aircraft. Because of this emphasis on physical systems, the personnel who design flight simulators are almost exclusively engineers. Assistance is sometimes provided by behavioral scientists and flight training specialists, but the influence of the latter upon simulator design is seldom significant. As a result, flight training simulators usually reflect physical rather than behavioral models. Deficiency - the relationships between the physical features of flight simulators and the training for which they primarily were intended is not always apparent. Objective - some of the relationships between these physical models and training will be examined to suggest an approach in simulator design that will result in more effective simulators. How research contributes - better accomplishment is expected of the basic purpose of the training simulator - effective training, from the approach to be employed.

The approach involves the development of non-physical or behavioral models which can be employed, along with the current employed physical models, in the design of future Air Force flight training simulators.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0009, HUMAN OPERATOR CONTROL STRATEGY MODEL

J.L. BIRCHFIELD, Georgia Inst. of Technology, Graduate School, *Atlanta, Georgia* 30332 (DF228160; F33615-77-C-0042)

To develop a model of human operator control strategy on perceptual/motor tasks such as those involved in flying. The work will also include a preliminary investigation of how control strategy is related to cue sampling and interpretation, learning, and changes in task variables such as performance criteria and task difficulty. Planned use of the model will be in performing measurement applications for simulation, training, and transfer of training research.

The approach is to conduct a survey and develop a summary of human performance characteristics that should be considered in developing a control strategy model. Then, based on that data, a theory of control strategy development and learning will be formalized, precise operational definitions of control strategy applicable to the tasks of interest set forth, and a model formulated. Preliminary tests of the model will be performed to demonstrate its validity, detect problem areas, and investigate basic relationships between control strategy and learning, cue sampling and utilization, and task variables. The manual control task used for the preliminary tests will be implemented on the simulation and training advanced research system for use by the Air Force in more extensive testing and continued modeling studies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0010, STUDY OF PHYSIOLOGICAL EFFECTS OF HEAD COOLING SYSTEM

V. IACONO, U.S. Army, Natick Research & Dev. Command, *Natick, Massachusetts* 01760 (DA0G4408)

To provide an individual cooling system for combat vehicle crewman, helicopter pilots, operators of heavy equipment (combat engineers) and special mission personnel requiring protective clothing. This system will alleviate those personnel working in hot environments from the hazard of heat stress. This work unit will focus on the physiological effects of the system on the soldier.

The individual conditioning system will consist of a thin, flexible cooling liner to be used in conjunction with combat helmets. The liner or liquid transport caps will contain a channeled manifold for circulating a cooled fluid around the head and neck areas. The source of cooling medium will be supplied from a portable modular unit which will contain optional modes for providing temperature regulation of the cooling fluid. This device will utilize semiconductor material to generate electric power and the Electrolux-Servel absorption process for refrigeration.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

6.0011, A MODEL OF THE HUMAN EYE-LEVEL BLOOD FLOW RESPONDING TO G STRESS

J.J. FREEMAN, Univ. of Detroit, School of Engineering, *Detroit, Michigan* 48221 (DF047930; AF-AFOSR-3262-77)

AF function - USAF crewmembers operating high-performance aircraft are exposed to increasing levels of rapid-onset, long-duration, repetitive manuevering forces which can impose certain physiological responses that can affect operator performance in aerial combat. There is a need to develop and assess a model which can be used to predict eye-level blood flow in human subjects exposed to g stress. Deficiency - there is a need to predict subject 'grey-out' and/or 'black-out' under only gz stimulus. This study seeks to develop a model which correlates gz and blood pressure and blood flow in the temporal artery during simulated aerial combat manuevers on the USAF centrifuge. Objective -the overall objective will be to interpret closed-loop baroceptor reflex mechanisms in humans exposed to g forces simulating aerial combat manuevers. How research contributes - this work should provide essential information to understand more fully the relation between g forces and blood pressure. In addition, since blood flow to the head, even more so than blood pressure, is relevant to the mechanism of g-induced loss of vision and consciousness, this study will also permit a description of blood flow as a function of g stress.

The study will employ a simulation model of eye-level blood pressure versus gz stress from averaged data on human subjects. The model will then be used to relate eye-level blood pressure and flow. The model will be tested, using frequency and time error analysis techniques, on data generated by scientists at the USAFSAM.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0012, THE INVESTIGATION OF METABOLIC AND CARDIOVASCULAR RESPONSES TO FATIGUING STATIC EFFORT

A.R. LIND, St. Louis University, School of Medicine, *St. Louis, Missouri* 63104 (DF034830; AF-AFOSR-3084-76)

AF function - the basic theme of this effort involves comprehensive studies of the metabolic, cardiovascular and respiratory responses to muscular exercise and to assess the relationship of physiological conditioning. Endurance and fatigue and their relationship to aircrew performance is of utmost interest to the Air Force. Deficiency - the proposed research is a logical extension of the PI's previous work in skeletal muscle physiology but with

emphasis on female subjects. Basic questions regarding the comparability in skeletal muscle strength and endurance between men and women is particularly significant to the USAF because of the current emphasis on full utilization of women - including flying. Objective - this effort will focus attention on the investigation of the ability of females to exert isometric strength to maintain submaximum tensions to fatigue and to the recovery of both strength and endurance after fatigue. The physiological responses of the women subjects will also be measured. How research contributes - this research directly addresses research needs identified under ROs 1.7 and 1.5.

Experiments using male and female subjects will be conducted to investigate the cause of fatigue and the differences in those causes that exist between men and women. Aspects to be studied include -relationships between isometric strength and endurance at four different sub-maximal tensions, at varying muscle temperature, assessment of loss of isometric endurance in successful contractions held to fatigue when the intervals between contractions is varied 3-20 mins, determination of the rate of recovery of muscles to exert maximal strength and to sustain submaximal isometric contractions after the development of fatigue at varying tensions less than mvc, measurement of local blood flow to muscle performing sustained sub-maximal tensions at controlled muscle temperature in women who are or who are not taking oral contraceptives.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0013, DEVELOPING PHYSIOLOGICAL INDICES FOR PREDICTING DECONDITIONING UNDER EXTENDED PERIODS OF WEIGHTLESSNESS

F. BECKMAN, City University of New York, School of Science, *Brooklyn, New York* 11210 (NCA 2-75801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0014, VCS APPLICATIONS

J.H. BRINDLE, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321180)

The purpose of this work unit is to develop and evaluate advanced integrated control/display concepts and equipment applicable to real-time reconnaissance and weapon delivery functions. This effort combines the utilization of operator-centered control and display technology to provide integrated optimized operator interfaces with selected weapon subsystems. Systematic evaluations of the concepts are performed to determine the overall utility and performance of advanced state-of-the-art control and display concepts as they are applied to advanced reconnaissance and weapon delivery systems under development. Areas of study will include the use of the head and eye to direct fire control systems, provide weapon systems guidance, control reconnaissance systems and select display information. This effort supports AFSC development goals TC-2, TC-4, TC-5, TC-7, and MS-4, and PMDR-P2033(5)64708F/5973, visual coupling aids.

Several specially configured test-bed aircraft associated with specific test projects will serve as the airborne testing facilities. In most cases a slewable sensor/designator will be interfaced with helmet-mounted sight/display systems. Sensor imagery can be presented in either helmet-mounted or panel-mounted display modes, coupled with joystick and/or helmet-mounted sight control of the sensor/designator. The interactive use of symbology with sensor imagery will be investigated where appropriate. In addition, ground vibration tests will be conducted to identify the characteristics of vibration-induced error in helmet-mounted sight tracking. From this data, matched filters will be developed to reduce a significant portion of the tracking error experienced in airborne missions. The integration of HMS/D systems and symbology generation systems along with system software development will be accomplished for concept demonstrations of the hemispherical HUD, visual communications and cueing/designation. This work unit, in part, encompasses work previously performed under work unit 7184-04-44, control/display integration and evaluation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0015, CREW SAFETY ASSESSMENT FOR AIR COMBAT FIGHTER (F-16)

J.W. BRINKLEY, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322760)

The F-16 aircraft incorporates new crew station design innovations to improve pilot performance under combat conditions. These innovations include an ejection seat reclined at 30 degrees back angle to improve performance under high maneuvering acceleration and a polycarbonate canopy without a conventional windshield structure. The canopy does not obstruct the pilot's vision in the area forward of the ejection seat headrest. The objective of this effort is to evaluate the performance of the F-16 ejection seat by review of rocket sled test data and to evaluate the crew injury potential associated with bird impact on the aircraft canopy. Assessment of the effects of inadvertent canopy loss on the pilot's ability to control the aircraft or initiate ejection is studied under work unit 72310655.

Assistance will be provided in preparation of a test plan for demonstration tests of the S111S-3 ejection seat using the rocket sled at Holloman AFB. Consultation will be provided on development of test data processing. Acceleration data recorded during the ejection tests will be analyzed to determine compliance with the acceleration limit criterion that has been provided in MIL-S-9479B. A test plan will be developed to evaluate the F-16 canopy's birdstrike protection capabilities. Impact exposure criteria will be developed using available biotechnology data. A special test rig will be designed and fabricated to measure the forces and moments acting on a helmeted headform during birdstrike tests at the Arnold Engineering Development Center. The testing and data analysis will be accomplished under a memorandum of agreement between the Air Force Flight Dynamics Laboratory, the Materials Laboratory, the Aerospace Medical Division and the F-16 System Program Office.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0016, AERIAL GUNNERY PART-TASK TRAINER - PHASE II

W.B. CAMPBELL, U.S. Air Force, Human Resources Laboratory, *Dayton, Ohio* 45433 (DF228330)

The objectives of this work unit are: (1) to develop a performance specification for procurement of a part task trainer which can provide training in the final portion of the aerial gunnery mission for tactical fighter pilots, and (2) to support Air Force Avionics Laboratory (AFAL) in administering a contract to procure an aerial gunnery part task trainer. This work will refine the technology for use of behavioral data in development of part task trainers and will result in procurement of an aerial gunnery part task trainer for Tactical Air Command. Technology gained as a result of this effort will be transitioned to organizations responsible for the design and procurement of training devices for advanced Air Force systems.

This work unit is for the second phase of a three-phase program. Phase I identified performance skills, measures, and training requirements for the final portion of the aerial gunnery mission. Conceptual designs for trainers were also developed. A prototype trainer will be constructed by industry under contract to AFAL during Phase II. Construction, engineering test, and delivery to a TAC base will be accomplished from Jul 77 to Aug 78. AFHRL will provide support to AFAL during Phase II by writing a performance specification for the trainer (Nov 76 to Jan 77). AFHRL will participate in the source selection (Apr-May 77) and will provide assistance in monitoring the contract (Jul 77-Aug 78). AFHRL, AFAL, and TAC will conduct a phase III training effectiveness study during Sep 78-Jun 79 (approx.).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0017, MEASUREMENT, PREDICTION AND EVALUATION OF BIOENVIRONMENTAL NOISE IN SUPPORT OF AF SYSTEMS/OPERATIONS

N.A. FARINACCI, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321430)

The goal is to provide technical support required by system program offices, majcoms, airbases, AF labs, and others on specific environmental noise problems that would otherwise be outside the scope of AMRL's R&D program. This support provides 200 to 300 customers per year with the data, procedures, software, and guidance needed to define and evaluate crew and community noise problems caused by specific existing or planned Air Force operations. The range of problems include: AICUZ, noise exposure/levels for environmental impact statements, facility siting, real estate decisions, monitoring of airbase noise, sound propagation, runup noise suppressors, identifying hazardous noise areas/operations, and computational/analytical methods.

The approach is to measure, predict and evaluate the customer's specific noise problem by applying the instrumentation, measurement methods, noisebank, omega software, predictive methods and other tools developed by AMRL. Travel/per diem costs will generally be paid by the customer. Results will usually be documented in the form of letter reports or memoranda.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0018, BIOLOGICAL MATERIAL PROPERTIES AND BIODYNAMIC MECHANISMS

I. KALEPS, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF320830)

It is of utmost importance in the development of aerospace manned systems to be able to predict the injury potential to the human occupant of such systems during the design phase. Various approximate analytic and computer modeling techniques have been developed for this purpose; however, the proper implementation of these methods requires a detailed knowledge of the structure, dynamic response and injury mechanisms of the human body. It is the purpose of this effort to assimilate such data and reduce it to the proper form for inclusion in various highly sophisticated biodynamic body models. This will allow predictions of human body response to various and complex mechanical force applications and respective assessments of injury potential.

Analytic and computer model descriptions of the function, structure and dynamic behavior of human biodynamic subsystems will be developed. These studies will be paralleled by investigations of spinal material properties and structure as well as ligament, bone and other tissue properties, infrasound interaction with respiratory function and internal forces and ranges of motions of joints. Efforts will be made to integrate the subsystem characteristics into more encompassing models describing segmental or total body response.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0019, COMPARATIVE RESPONSE OF MAN AND ANIMALS EXPOSED TO IMPACT

L.E. KAZARIAN, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322420)

Spinal injuries due to abrupt gz impact forces occur frequently in the operational Air Force environment. Injury patterns experienced are diversified, and range from simple vertebral body fracture to vertebral subluxation with spinal cord and nerve root involvement. The objective of this investigation is to provide an in-depth biomechanical and clinical analysis of operational spinal injury patterns for purposes of supporting injury prediction model development, which will in turn be used as system design aids, and further to understand the microscopic and macroscopic failure mechanisms which are involved in the kinetic and kinematic events resulting in injury.

Interspecies scaling relationships will be formulated between the squirrel monkey, rhesus monkey, baboon, chimpanzee and man. The musculoskeletal system will be modeled based upon geometry and material property data. Experimental data will be collected on isolated vertebral bodies, vertebral units and the points of rib articulation. Data will be collected on the ranges of torso motion. These data will be integrated into a generalized mathematical model of the torso. Experimental data will be collected on injury modes and correlated to specific support and restraint goemetries for model injury prediction validation. Subsequent studies will be made applying the model to the predictive analysis of injury for various restraint configurations and modes of human exposure in potential and existent Air Force systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0020, DESIGN AND EVALUATION OF WORK STATIONS

K.W. KENNEDY, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF320960)

New AF manned systems require crew and work station designs that represent departures from those seen in current systems. The purpose of this effort is to derive pilot and crew body- size and biomechanical data to guide the design of crew stations and of ground support work stations. Much of this information will be used to derive new military standards to guide the design and evaluation of crew station geometries. Attention is given to safe and efficient accommodation of the variability of body sizes, proportions, and mobility characteristics, whether lightly clad or encumbered by protective equipment, and whether flying or working in normal or stressful environments.

Body size, body clearances, arm- and leg-reach capabilities, and vision envelopes are measured on subjects representative of AF personnel. Effects on these measures by varing body supports, i.e., seat back angles 10 to 75 degrees, and different environmental stresses, i.e., two to 11 gs are examined. Cockpit geometry standards will be developed during FY 77 and 78 to specify the layout of controls, design of body supports and escape envelopes of advanced systems. Three-dimensional analyses of 5th, 50th, and 95th percentile reach envelopes for men and women will be completed for the seated position (13 degree back angle, 6 degree seat) during FY 77. Analyses for back angles of 10 degrees, 20 degrees, and 30 degrees and the technique to reconstruct the reach envelopes for any back angle between 10 degrees and 30 degrees will be developed during fy 77. Effects of encumbering personal-protective equipment on these measures are also evaluated. Interact with other federal agencies on programs of mutual interest. Provide consultation and support in research primarily of interest to other federal agencies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0021, CONFUSION SYSTEMS

R.D. ODONNELL, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321070)

To develop a fundamental data base on the mechanisms of visual sensation and perception capable of disrupting optical tracking and target identification. From the population of visual functions used in tracking and identification tasks, to isolate those which are capable of being distorted by some external manipulation. For these functions, to define the parameters within which such distortion might occur. The ultimate objective is to develop a systematized base of data from which the 'area of confusability' of any given visual function can be readily identified. This base will then permit objective definition of potential countermeasures in terms of a priori probability of success. Supports AFSC development goals S0-5, TC-5 and TC-8.

A committee on high-level national figures will be organized under a separate work unit to outline, in broad form, the visual functions most susceptible to disruption. This committee will similarly define risk/payoff matrices, and will identify additional requirements in the area of visual factors of optical countermeasures. These visual factors will then be studied in terms of the spatial, energy, spectral, and/or temporal parameters comprising them. Laboratory studies will be conducted to assess the impact on visual perceptual processes of manipulations of these parameters. An extensive literature search will be carried out to systematically identify work in which such parameters have previously been established. From these sources, definitive confusability matrices will be evolved. From a broader view, when enough in-

formation has been gathered to define these matrices, a describing function relating operator performance to broad ranges of sensory and cognitive perturbations will be developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0022, JTIDS SYMBOLOGY AND WORKLOAD

W.H. PEARSON, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF323380)

The symbology standardization committee (SSC) of the ESD JTIDS SPO has recommended symbology to be used on a joint tactical information distribution system (JTIDS) display during a flight test of the design concept. The objective of this work unit, in compliance with further recommendations of the SSC, is to evaluate the proposed symbols, identify symbols which can be processed more rapidly, and evaluate the workload imposed by use of the JTIDS display in a simulated tactical environment. A summary and synthesis of pertinent literature will also be prepared.

A progressive series of related experiments has been planned ranging from research obtained under a 6.1 program effort (experiment 1) to a system simulation (experiment 4). They are: 1) Printed (white on black) versions of the candidate symbols will be evaluated experimentally on a sample of subjects using a modified paired-comparison technique to obtain discriminability indices. (2) Samples from populations of differing experiential background (e.g., pilots familiar with other symbology, fighter-bomber pilots, and non-military subjects) will be required to construct symbols representing tactical intelligence events, objects or conditions. The most common symbols will be selected for further evaluation. (3) The candidate symbol sets generated via (1) and (2) above will be tested further in an experiment in which the time required to establish associations between symbols and objects, events, or conditions will be obtained. (4) A part-task JTIDS mission simulation will be developed and used to test the compatibility of JTIDS task demands with other pilot tasks.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0023, ELECTRONIC WARFARE CREW STATION DESIGN AND PERFORMANCE ASSESSMENT

E.D. SHARP, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF316620)

The objective of this work unit is to integrate B-52 electronic warfare (EW) crew station design with emphasis on improving the utilization and effectiveness of the operator as part of the weapon system. In-house and contractual efforts through real-time simulation yield control display criteria for specific designs, overall crew station designs and technology advancements suitable for future applications.

The approach to this effort is to make maximum use of real-time, man-in-the-loop simulation to define, quantify and analyze operator performance in present and future EW crew stations, establish criteria for control display layout system integration and crew performance workload and workload distribution. Controlled mission conditions will be simulated to investigate systematic changes in crew station designs with respect to overall workload and operator performance as a result of the addition of prototype systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0024, LOUDNESS BALANCE METHOD OF EVALUATING HEARING PROTECTORS

M.R. STEPHENSON, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321300)

The hearing protection features of helmets, headsets and hearing protectors are currently evaluated using standard methods that employ very low level signals. Evaluation procedures that use high-level test signals may provide more valid estimates of protector performance in intense noise fields. The objective of this work unit is to assess the validity and accuracy of a suprathreshold loudness balance method of evaluating hearing protectors. Current hearing protector evaluations conducted by the AF employ the standard ANSI real ear attenuation at threshold (REAT) method as the test instrument to define hearing protector performance. This work unit will evaluate the relative merits of the loudness balance method to determine which method is the most effective procedure for predicting performance of hearing protectors relative to procedures identified in AFR 161-35.

Human subjects will balance the loudness of narrow bands of noise, presented through loudspeakers, with a 1 kHz puretone presented through an ear insert receiver. Measurements will be conducted with the subjects' alternately having their test ear exposed to the noise bands and being occluded by ear muffs. Preliminary data indicate the loudness balance method and REAT method result in considerably different hearing protection values. The experimental procedure will attempt to identify the reason(s) for these differences through a systematic manipulation of the independent variables. This effort will provide technology to be used to validate or to recommend changes to current estimation procedures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0025, CONFERENCE APRIL 1978 'CELL AND MOLECULAR BIOLOGY IN SPACE'

B. DIEHN, Univ. of Toledo, Graduate School, *Toledo, Ohio* 43606 (NSG 7424)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0026, MECHANISMS OF BLOOD FLOW CHANGES DURING GRAVITATIONAL STRESS

H.L. STONE, Univ. of Oklahoma, School of Medicine, *Oklahoma City, Oklahoma* 73104 (NSG 2312)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0027, METABOLISM OF HYDRAZINE

F.N. DOST, Oregon State Higher Educ. Sys., School of Agriculture, *Corvallis, Oregon* 97331 (DF320680; F33615-77-C-0500)

Research is needed to characterize metabolic pathways of potential Air Force pollutants in selected animal species to provide data for estimating if man metabolizes compounds similar to specific animals. Metabolic pathways must be identified for risk prediction on potential chemical oncogenic compounds. In particular, the biological effects of hydrazine exposure have been and are being extensively investigated, but the metabolic disposition of at least 50 percent of administered hydrazine is still unknown. The specific objective is to study the metabolic fate of the missile propellant hydrazine to aid in a better understanding of the oncogenic potential of the compound. The data will also help to develop toxicity criteria for the USAF as required by AFR 19-1.

The research proposed here is first intended to account for all hydrazine nitrogen administered, by determining the amount of hydrazine nitrogen that appears in respiration, urine and tissues as hydrazine, N2 and ammonia, and other metabolites. The potential for formation of certain probable intermediates, particularly diimide, will also be studied. The investigation will utilize the rat as the primary research animal while various chemical analyses and mass spectroscopic measurements of 15 N from 15 N-hydrazine will be employed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0028, COUNTER-CURRENT DISTRIBUTION OF BIOLOGIC CELLS

D.E. BROOKS, Oregon State Higher Educ. Sys., School of Medicine, *Portland, Oregon* 97201 (NAS 8-32817)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0029, EFFECTS OF COMBINED STRESSES ON NAVAL AIRCREW PERFORMANCE

J. BOWMAN, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974 (DN233054)

To study the effects of combined stresses on aircrew performance and fatigue under dynamic conditions simulating the operational environments of fighter/attack, patrol/support, and helicopter aircraft, in order to improve crew proficiency and safety of flight operations, to quantify the extent to which each stress contributes to total fatigue, and to define the actual mechanisms by which these stresses affect the aircrews. Requirements for this work are included in the FY 1974 naval aviation biomedicine/human effectiveness report.

Physiological and performance data will be collected from trained personnel performing simulated aircrew tasks while being exposed to various combinations of stresses similar in intensity and duration to those encountered during flight in military aircraft. Stresses include accelerations, vibrations (buffet), noise, ambient temperature and pressure, ambient light levels, and the restrictions to mobility and vision imposed by wearing personal protective equipment and using restraint devices. Through appropriate experimental designs, the separate and combined effect (interactions) of the stresses will be studied. Operational simulations of present and future high-performance aircraft will be made using the NADC Dynamic Flight Simulator (DFS).

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Medical Research Inst.

6.0030, CUMULATIVE PATHOPHYSIOLOGIC LIMITS TO REPEATED EXPOSURE OF HIGH G

J.W. BURNS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322580)

It has been demonstrated that exposure of experimental animals to operational levels of high sustained acceleration can produce myocardial pathology. The degree of pathologic injury can be determined through available histologic techniques. However, it is also very important to extensively investigate the relationship between the observed pathology and functional changes that may occur in the cardiovascular system. It is the objective of this effort to determine if there is a pathophysiologic relationship resulting from high sustained repetitive and cumulative acceleration, and if so, to define physiologic endpoints which should not be safely exceeded.

Miniature swine and subhuman primates will be used for the majority of these studies. Uninstrumented as well as chronically instrumented animals will be subjected to operational acceleration levels over varying periods of time to define the cumulative pathophysiology of acceleration stress. In this manner a data base will be developed which will be continuously updated with pathophysiologic information from both species as the cumulative exposure time increases. The USAFSAM centrifuge will be used to expose the experimental subjects to the various g stresses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0031, USAF HEARING CONSERVATION PROGRAM

D.C. GASAWAY, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322030)

Many USAF weapon systems and support operations represent potential risk to the hearing of both military and civilian personnel. Loss of highly trained personnel and compensation for hearing loss continue to be major Air Force problems. The primary objective of this effort is to monitor the USAF hearing conservation program, specifically as defined in AFR 161-35, 'hazardous noise exposure' 29 July 1973. The prevention of noise-induced hearing loss among AF members, both military and civilian, requires that these personnel be included in a comprehensive hearing conservation program and the purpose of this research is to guarantee that the multifarious elements of the program are effective. In addition, research will be performed to validate auditory risk limits, determine the effectiveness of personal ear protection devices and noise control measures, and insure adequacy of criteria and procedures for disposition of noise-exposed personnel who demonstrate shifts in hearing.

Air Force forms 1490 and 1491 and associated documents received at the USAF hearing conservation data registry will receive quality control and then be processed by automated techniques. Computer readouts on a routine basis will be used to continually appraise and evaluate the effectiveness of the overall hearing conservation program. The effectiveness of different elements (military or civilian) at a single base will be continually appraised. Instrumentation utilized in monitoring audiometry, personal ear protection, and disposition procedures for personnel who demonstrate shifts will be assessed on a continuing basis. Methods and techniques used to monitor individuals exposed to potentially hazardous noise will also be continually evaluated and deficiencies, once identified, will be carefully studied so that corrective action(s) can be recommended. Auditory acuity of various groups and subgroups of personnel who work in noise will be studied. Recommendations for correction of problem areas will be made to command surgeons and HQ USAF/SGP, as appropriate. This work was formerly documented under work unit 7755-08-02.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0032, FEASIBILITY EVALUATION OF SIX-MAN OPEN-LOOP OXYGEN GENERATION SYSTEMS (OLOGS) FOR B-1 AIRCRAFT

L.J. LUSKUS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322240)

To test for human compatibility current on-board oxygen generating systems as they become available. The test will include a fluomine based OLOGS, the GE electrochemical device and the Bendix and Garret molecular sieve systems.

Flight prototype systems will be tested for contaminant off-gassing and human physiologic compatibility under simulated flight profiles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0033, STRESS/WORKLOAD CRITERIA FOR EVALUATION OF IMPROVED AIRCRAFT INSTRUMENTATION

W.F. STORM, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF319930)

The objectives of this work unit are to (a) quantify the relationships between psychobiological/biochemical indices of fatigue and stress with pilot performance during missions/sorties systematically varying in workload, (b) document pilot acceptance of new aircraft instrumentation, and (c) quantify the relationship between inflight electrocardiograms and behavioral/biochemical measures for identical maneuvers flown in different modes.

Establishing the correlation between psychobiological indices of fatigue and stress with pilot performance parameters developed by the instrument flight center (IFC) will form a data base for future predictions of pilot fatigue during short-duration missions. The analysis of changes in psychobiological measures during identical missions with different instruments/conditions provides an additional parameter for evaluation of instrument effectiveness. Portions of this effort were documented previously under 7930-09-11 and 7930-10-07.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0034, MICROWAVE EFFECTS

T.J. TREDICI, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF323050)

The objective of this unit is to provide detailed initial ophthalmologic evaluation and follow-up, as clinically indicated, for those USAF personnel who have suffered a microwave overexposure, i.e., normally those calculated to have been exposed to greater than twice the permissible exposure limit (PEL).

This work is further directed by Air Force regulation 161-42. Finally, attention will be focused on the presence or absence of lenticular lesions and their possible causal relation to the microwave exposure.

Patients will be evaluated in the Ophthalmology Branch, Clinical Sciences Division, following standard patient evaluation protocols. Follow-up over time will be established on an individual basis and reports will be made to the referring physician and medical facility. When sufficient data have been accumulated, scientific publication of the material will be made in scientific journals. Work was formerly documented under work unit 77550905.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0035, CORTISOL RISK FUNCTION

R.G. TROXLER, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321810)

Previous study has determined that USAF aircrew members with severe coronary artery disease (CAD) have increased levels of plasma cortisol, a hormone released into the blood during mental stress. Statistical analysis has shown that cortisol may be a new risk factor for coronary artery disease. The objective of this work unit is to study cortisol in all aeromedical consultation patients to determine if this relationship is constant and independent of other risk factors for CAD. A second objective is to study the effect of cortisol on the development of atherosclerosis in subhuman primates.

Plasma cortisol will be analyzed routinely on all USAF aircrew members referred to USAFSAM. Cortisol determinations on patients evaluated by coronary angiography will be statistically tested to determine if cortisol is an independent risk factor for CAD. The components of the variability of cortisol will also be defined. A controlled study using 50 nonhuman primates will compare the effect of exogenous cortisol on the rate of development of atherosclerosis in the presence and absence of a high-cholesterol diet. This work was formerly documented under 7755-05-07.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0036, ESTABLISHMENT OF STANDARDIZED EXERCISE STRESS TESTS FOR CORONARY ARTERY DISEASE IMMEDIATE RISK FUNCTION

R.L. WOLTHUIS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321620)

The leading medical cause for removal of aircrewmembers from flying status is disease involving the circulatory system. This effort is to determine the value of exercise stress testing in the early detection of cardiopulmonary disease and in quantifying the significance of such disease to the flyer, and to establish a standardized reliable exercise stress test that can be used in the field.

Aircrewmembers are studied during maximal exertion to provide better understanding of the normal/abnormal circulatory and electrocardiographic responses and the influence of disease and physical conditioning on these responses. Studies of exercise stress testing procedures and monitoring methods including automated ECG analysis as well as the development of better methods for measuring work performance will continue. This work was formerly documented under 7755-01-02.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0037, RADIOGRAPHIC AND BIOMECHANICAL STUDIES OF THE HUMAN SPINE

M.H. POPE, Univ. of Vermont St. Agr. Col., School of Technology, *Burlington, Vermont* 05401 (DF039510; AF-AFOSR-2738-74)

AF function - the Air Force operational environment involves exposure of personnel to a wide variety of mechanical forces including vibration, acceleration, flail and impact. The musculo-skeletal system is severely affected by these forces, especially in instances of ejection from high performance aircraft where the probability of disabling injury from flail and impact is unacceptably high. Deficiency - a model for predicting human responses has been under development under AMD guidance. Data from intact human spinal columns subjected to representative forces is required. Objective - the dynamic responses of the spine to controlled rates of compressive loading will be determined. How work contributes - data from this study is needed to verify developing models and will provide direction of future research.

Precisely measured forces will be applied to fresh intact cadaver spines. Spinal geometry will be studied through bioplanar X-rays.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, COMPUTER-AIDED GEOMETRIC DESIGN

G.M. NIELSON, Arizona State University, School of Liberal Arts, *Tempe, Arizona* 85281 (DN223592; N00014-75-C-0244)

The purpose of this research is to devise new ways of approximating shapes (mathematical functions) used to define curves and surfaces in the process of computer-aided geometric design (CAGD). CAGD is already used to design a wide variety of Navy vehicles (e.g., it is used to design aircraft and shop exteriors). CAGD can be extended to design almost every mechanical component of naval vehicles and weapons. This extension depends upon the development of new fundamental tools for representing shapes; tools must be developed which allow the designer to carry out his intention without worrying about mathematical details of the representation.

This research will pursue techniques for approximating (primarily multivariate) functions. The search for new techniques will concentrate on two qualities. First, new ways of determining the approximates must be developed in order to given the designer-user flexibility and control. The traditional ways of determining approximates, e.g., interpolation, do not work in a design context. Secondly, the approximates should be definable over fairly complex domains, not just rectangular polygons. Also, emphasis will be placed on approximates which can be calculated easily. Ease of calculation is often critical for computer graphics applications.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0002, ESTIMATION AND IDENTIFICATION FOR MODELING DYNAMIC SYSTEMS

J.M. MENDEL, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (DF040480; AF-AFOSR-2797-75)

AF function - the study of dynamic models of air force systems. Deficiency - the mathematical models of aircraft navigation systems, jet engines, and flight control systems require frequent updates to reflect new information. Objective - the objective of this research is to develop new techniques to minimize the time required to develop new system models. How work contributes - success in this effort will result in new systematic approach to system modeling at reduced cost.

This research proposal is aimed at continuing efforts in two problem areas-- multistage modeling, estimation, and identification algorithms for dynamical systems and algorithms for approximate realization. In the first area of research, studies will be made on the possibility of combining either as nonsingular perturbation or a singular perturbation representation of a dynamical system and the Mendel/Washburn generalization of Friedland's bias decomposition to obtain a multistage k/b filter for weakly coupled systems. Effort will be spent to develop multistage versions of generalized least-squares, instrumental variable, and 2-stage least-squares algorithms for estimation of ARMA model parame-

ters. Also the study of the applicability of multistage decomposition, Efrogmson's stepwise regression and an extension of Efrogmson's method will be done to determine the order of an ARMA model. An examination of system theoretical concepts of observability, controllability and identifiability for causal functional equations will be accomplished. Finally, studies will be made for the identifiability of reflection coefficients, and reflection coefficients and time-delays, as well as algorithms for identifying these quantities, for causal functional equations. The second area of research will be the derivation of algorithms for approximate realization that are computationally efficient and numerically well-conditioned, and will be practically important.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0003, TWO-DIMENSIONAL MESH ADJUSTMENT ALGORITHM

C.M. ABLOW, S R I International, *Menlo Park*, *California* 94025 (DF048310; F49620-77-C-0114)

AF function - design of aerospace vehicles, study of nuclear weapons effects. Deficiency - the computation of functions with sharp variations requires small finite-difference intervals for accuracy for certian regions while in other regions large intervals are needed for economy of computer time. Numerical techniques which eliminate or reduce the loss of accuracy due to mesh irregularity are needed. Objective -this research will investigate the use of a uniform mesh in a transformed coordinate system that expands the boundary layer in fluid flow problems. Extension of one-dimensional techniques to 2d will be studied. How work contributes - techniques which may offer a reduction in storage in the computer with same accuracy may be obtained.

This effort will attempt to establish a transformation of coordinates that facilitates the finite-difference solution of partial differential equations in two dimensions. Analytical efforts will be spent to define the most campylotropic coordinate system for the solution of the PDE's. A rearrangement of the two-dimensional equations into uniquely solvable form will be derived. Methods for the approximation of the derivatives by finite differences and solving the resulting algebraic system will be explored. Questions on the range of applicability of the methods developed will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0004, COMPUTER ANALYSIS OF SHELLS AND COMPOSITES

D. BUSHNELL, Lockheed Missiles & Space Co., *Palo Alto*, *California* 94304 (DF049730; F49620-77-C-0122)

AF function - advanced aerospace vehicles rely on highly efficient structure to achieve mission objectives. Deficiency - durability of advanced composite materials under operating environmental conditions is not well understood. In addition, a comprehensive guide to shell and panel structure modeling and analysis does not exist. Objective - this research program involves two task efforts. The objective is to determine both steady-state and transient behavior of a composite laminate under exposure to moisture and high thermal states while establishing, at the same time, a comprehensive analysis and structural modeling guide for shell and panel structures. How work contributes -results of this effort will result in improved understanding and methods for highly efficient flight vehicle structures.

Task 1 - analysis techniques for determining thermal and concentration profiles in a laminate will be combined with standard finite-element analysis techniques. Resulting analysis capability will enable both transient and steady-state conditions to be treated. In addition, capability to handle viscoelasticity of matrix material will exist. With this tool, major effort will be to investigate hygrothermal effects on residual stress, interlaminar stress and free edge, stress behavior. Task 2 - two factors enter into the correct choice and effective use of a computer program for the analysis of structures of which thin shells and panels are significant parts: (1) the engineer must understand the physics of the problem well enough to be able to define his needs, (2) the engineer must be informed as to which programs will satisfy these needs. This task addresses primarily the first factor. Emphasis will be placed on practical shell structures which may be stiffened, segmented, branched, discontinuous, have complex composite wall constructions. Descriptions will be provided of some of the peculiarities of the behavior of shells, nonlinear behavior due to plasticity and large deflections, stress redistribution effects, stiffener and load eccentricity effects, bifurcation buckling, local vs. general instability, imperfection sensitivity, low-frequency bending vs. high-frequency extensional dynamic response, and fluid-shell interaction effects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0005, AN INVESTIGATION OF NUMERICAL METHODS FOR THE SPARSE GENERALIZED EIGENPROBLEM

S.F. MCCORMICK, Colorado State University, School of Natural Sciences, *Fort Collins*, *Colorado* 80523 (DF138700; AF-AFOSR-3019-76)

Large-scale structural analysis computer programs are basic tools in the design of weapons, airlift, and delivery systems. A basic component of these programs is an algorithm for the solution of large, sparse generalized eigenvalue problems. In typical applications the factorization of the component sparse matrices is not feasible because of size limitations of the central memory of the large computers. Few methods for the partial solution of the generalized eigenproblem apply in these situations. Moreover, almost all of the current methods are severly impaired when eigenvalue clustering occurs. The goals of the investigation are to develop, analyze, implement, and test potentially efficient numerical methods for solving the generalized eigenproblem in such a way that the algorithms are suitable for inclusion in the large-scale structural analysis programs.

Particular emphasis will be placed on a new approach which promises to desensitize the techniques from eigenvalue clustering. Of special importance will be tests conducted using the methods developed under this effort and comparing them with results obtained using the methods currently in use.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

7.0006, MULTIVARIABLE PROBLEMS OF STATISTICS AND INFORMATION THEORY

J.N. SRIVASTAVA, Colorado State University, School of Natural Sciences, *Fort Collins*, *Colorado* 80523 (DF046270; AF-AFOSR-3127-77)

AF function - command, control and communication - information retrieval systems - improve the methods of data collection and analysis. Deficiency - good and efficient statistical methods still need to be developed for collecting and analyzing data related to the different factors influencing the function of command, control and communication systems, hierarchical information retrieval schemes - pattern recognition and optimal design theory. Objective - develop good basic results to help improve coding methods, information retrieval systems, reduce costs and save time in the collection of large amounts of data without any damage to the statistical quality of the data being collected, improve the methods of clustering and pattern recognition. How work contributes - improve the methods used in investigations using experimental units that are scarce/or costly, improve the efficiency of coding schemes, help model the construction of hierarchical information retrieval schemes, improve the existing results in clustering used, for example, in pattern recognition.

Research will be conducted in several areas which can help the researchers from the beginning to the final stage of their experiments. The main problem areas to be studied are: (1) Finding upper bounds for the efficiency of codes, which help in finding optimum codes. Further work will be done on the properties and decoding of Srivastava codes, on codes designed for communication over a band limited channel perturbed by white Gaussian noise and satisfying an equal power input constraint. (2) Do further work on the construction of hierarchical information retrieval schemes. (3) Further work on the theory of optimal designs. (4) Hierarchical clustering. (5) Multivariate analysis and multiresponse designs, particularly on problems with missing data. (6) Choice of variables in regression analysis. (7) Search linear models, particularly the inference aspect of such models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0007, CORE GRAPHICS SYSTEM FOR RASTER GRAPHICS DISPLAYS
J.D. FOLEY, George Washington Univ., School of Engin. & Appl. Sci., *Washington, District of Columbia* 20037 (NSG 1508)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0008, CONCATENATED CODING SYSTEM STUDY
UNKNOWN, George Washington Univ., Graduate School, *Washington, District of Columbia* 20006 (NAS 5-24431)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0009, DEVELOPMENT AND OPERATION OF AN AIR TRANSPORTATION RESEARCH INFORMATION SERVICE (ATRIS)
UNKNOWN, Transportation Res. Board, *Washington, District of Columbia* 20037 (FA77WA-4079; FA160427 (TRAIS NO.))

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

7.0010, MODIFIED MAXIMUM LIKELIHOOD ESTIMATION TECHNIQUES APPLIED TO PILOT MODELING
R.C. RAPSON, State University of Fla. Sys., School of Engineering, *Orlando, Florida* 32816 (NSG 4016)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0011, NUMERICAL SIMULATION OF PLASMAS
J. DENAVIT, Northwestern University, Technological Institute, *Evanston, Illinois* 60201 (DN223216; N00014-75-C-0473)

The objective is to carry out research on the numerical simulation of plasmas and their interaction with electromagnetic fields. Such interactions are important in that, for example, the application of magnetic fields to moving plasmas provides a means of converting the thermal energy of combustion or fission directly to electrical power without the use of mechanical generators. Further, ionization effects in plasmas are important for radiofrequency communications and telemetry from space and reentry vehicles. The work is thus of interest to the Navy in communications systems via the ionosphere, power sources, in ballistic missile and atomic weapons effects, and satellite surveillance.

Numerical methods for the simulation of collisionless plasmas will be developed based on periodic smoothing in phase space and time filtering of the fields. Smoothing in phase space will provide noiseless solutions over long times. Time filtering of the fields will allow for the use of time steps not limited by high-frequency electron oscillations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0012, NONPARAMETRIC STATISTICS
M.L. PURI, Indiana University, School of Arts & Sciences, *Bloomington, Indiana* 47401 (DF042230; AF-AFOSR-2927-76)

AF function - signal detection and communication, meteorology and forecasting airfield ceiling conditions, missile targeting and target localization. Opportunity - continuation of the work in progress by the principal investigator will have far reaching impact on the above problems. Objective - develop the statistical methodologies applicable to problems in communication theory, signal detection, meteorology and forecasting, target localization and missile targeting. How work contributes - the development of these statistical methods will make available sound and easily implementable theoretical basis for the development of hardware and methods related to the above-mentioned Air Force functions.

Some of the specific areas in which it is proposed to do research are (a) discriminant analysis, (b) some distributions theory problems encountered in the analysis of circular data, (c) asymptotic theory of rank order statistics, (d) development of nonparametric procedures to different classes of stochastic processes, (e) order statistics from the non-normal populations, (f) multivariate procedures based on spherical distributions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0013, INVESTIGATION OF IMPROVED MODAL PARAMETER ESTIMATION TECHNIQUES
D.L. BROWN, Univ. of Cincinnati, Graduate School, *Cincinnati, Ohio* 45221 (NSG 1486)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0014, NUMERICAL ANALYSIS AND MACHINE COMPUTATIONS
P.J. NIKOLAI, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF136330)

Computational algorithms are necessary for improved analysis and simulation of performance in the development of complex weapons and delivery systems, but in many cases the algorithms are unavailable, and in others they are inadequate. The goal of this work is to develop practical, effective and efficient algorithms for the solution of numerical problems arising in typical computing tasks which occur repeatedly in different settings. Research is concerned with more accurate and efficient solution of the algebraic eigenvalue problem and the solution of large systems of linear algebraic equations, both basic computations in the analysis of loading of flight vehicle structures. This work leads naturally to wide-ranging consulting activities in regard to implementing computer algorithms, to efficient use of available computing resources and to procuring additional computing resources should this prove desirable.

The computational algorithms selected for analysis and implementation are determined by requirements arising within the task and by needs communicated through consulting activities within the laboratory as a whole. A given computational requirement may be satisfied by various competing methods. Algorithms arising from these methods are analyzed and evaluated for possible implementation as subroutines for available digital computers. These studies emphasize the extension of existing theory and the development of new algorithms when a realistic survey of existing methods reveals deficiencies either in performance or documentation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

7.0015, RESEARCH IN DIFFERENTIAL GAME THEORY
M. MINTZ, Univ. of Pennsylvania, School of Electrical Engin., *Philadelphia, Pennsylvania* 19104 (DF048690; AF-AFOSR-3327-77)

AF function - research in differential game theory for conventional Air Force weapons systems. Deficiency - mathematical models for determining evasion strategies for an aircraft threatened by a multiple-missile attack has not been fully investigated. Objective - the objective of this research is to develop an improved mathematical model which (1) accounts for the uncertainties and modeling errors associated with the dynamics of multiple pursuing missile, and (2) leads to the determination of a suitably robust algorithm for specifying the optimal evasion stategies. How work contributes - success here would allow system operational planners to devise methods to avoid hostile air-to-air or surface-to-air attacks on planned air missions.

The proposed research will be divided into three related areas. First, the development of an improved mathematical model which accounts for uncertainties in the assumed missile dynamics

which are used in the determination of the optimal evasion strategies will be investigated. Second, the computation of saddle-point solutions for the current mathematical/computer model developed under previous research which assumes simplified dynamics and perfect information will be pursued. Finally, there will be simulation studies to determine the sensitivity of the optimal evasion strategies to uncertainties in the underlying parameter's dynamic structure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, THEORETICAL ANALYSIS OF SCATTERING OF A LASER BEAM FROM ROUGH SURFACES 13913-P
C.C. SUNG, Univ. of Alabama, School of Science & Engin., *Huntsville, Alabama* 35807 (DA0F8901; DAAG29 77 G0051)

To obtain surface characteristics such as roughness, curvature and velocity of an object using the coherent radiation of a laser reflected from the surface. Relevance - the research has direct relevance to ongoing work at MICOM on reentry vehicles and reentry vehicle materials and ECOM on battlefield-surveillance, target acquisition and fire control.

Speckle statistics and the relationship between the average angular irradiance distribution of a reflected laser beam to the surface properties of a random rough surface will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0002, PSEUDOPOTENTIAL METHODS IN PHYSICS
W.A. HARRISON, Stanford University, Graduate School, *Palo Alto, California* 94305 (DMR77-21384)

This is a continuation of research previously supported under DMR-7302351. Theory relating the electronic structure of solids to the dielectric and bonding properties of those solids will be developed. A systematic set of matrix elements for transition-metal solids, analogous to those for simple solids, will be derived from the known electronic structure of a number of such systems. Calculations of various properties will be carried out in terms of these parameters. Also, elementary LCAO theory will be applied to covalent and ionic solids.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0003, NUCLEAR TRANSMUTATION DOPING OF GAAS
H. FRITZSCHE, Univ. of Chicago, School of Physical Sciences, *Chicago, Illinois* 60637 (DF044190; AF-AFOSR-3044-76)

AF function - microwave solid-state electronic devices are essential components of Air Force surveillance, countermeasure and communication systems. Opportunity - improved performance of devices that generate and process microwave signals can be expected from use of solid-state materials that are more uniformly doped while maintaining low defect concentrations. Objective - the objective of this research is to study a new method of doping high device quality GaAs crystalline materials. How work contributes - this research should perfect a method for preparing high-quality GaAs device material with highly reproducible, homogeneous, and well-controlled doping characteristics.

Pure or chemically doped GaAs will be exposed to a known flex of thermal neutrons. The capture of neutrons by the natural Ga and As isotope, and subsequent transmutation of the radioactive nucleus by beta decay will produce elements which act as donors.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0004, NONLINEAR MECHANICS OF UNSTABLE PLASMAS
H. LASHINSKY, Univ. of Maryland, Inst. for Fluid Dyn. & Math., *College Park, Maryland* 20742 (DF045870; AF-AFOSR-3129-76)

AF function - aerospace vehicles. Deficiency - knowledge of plasma resistivity pertaining to arc heated plasma wind tunnels is largely based on overall current and voltage measurements which cannot provide spatial resolution, the use of trial functions to describe the temperature dependence of the conductivity, also the physical theory of conductivity available is only valid for a range of plasma parameters different from those occurring under experimental conditions. This poor state-of-the-art hampers rationally based design improvements of arc plasma gas heating devices. Objective - to evaluate the feasibility of using a newly developed technique for measuring plasma electrical conductivity in plasma wind tunnels and plasma arcs, to investigate a newly discovered plasma transparency effect that could have applications to communication with vehicles otherwise in the plasma blackout situation. How work contributes - accurate measurements of gas electrical conductivity as a function of density, temperature, and magnetic field intensity will furnish a foundation for more satisfactory theories of these phenomena relevant to the actual parameter ranges of interest in plasma arcs and wind tunnels.

Q-machine plasmas of controlled temperature, density, magnetic field intensity and turbulence level will be probed to obtain conductivity both parallel and perpendicular to the field direction. A newly discovered transparency effect that is possibly capable of providing a communication window through dense reentry shock layer plasmas will also be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0005, EQUATION OF STATE AND CONDUCTIVITY OF A LASER-COMPRESSED ELECTRON-ION PLASMA
G. KALMAN, Boston University, School of Liberal Arts, *Boston, Massachusetts* 02215 (DF042790; AF-AFOSR-2960-76)

AF function - operation of high-altitude vehicles in a post-nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand a fundamental understanding occurring in high-pressure plasmas produced by laser irradiation of solid pellets. Deficiency - the aforementioned information required for the design of advanced equipment is not available today. Its acquisition may be realized by a well-planned theoretical and experimental research. Objective - this research will develop the equations of state as an input to the Rankine-Hugoniot equations to study the implosion dynamics of laser compressed plasmas. Contribution - this work is a part of a comprehensive program of plasma research for the development of an X-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam), the development of space and ionospheric communications, and the development of countermeasures.

During the plasma generation process of a laser irradiated pellet, strong coupling effects arise which preclude the possibility of using the perfect gas equation of state for the description of the highly compressed plasma. This research will perform the following: (a) continue the numerical and supplementary analytic work on the solution of one-component integral equation and start corresponding work on the two-component integral equation, (b) incorporate the equations of state to be obtained from numerical work or from analytic approximations in the Rankine-Hugoniot conditions governing the imploding shock wave dynamics in certain regions of the laser compressed fuel pellet, (c) study the dynamical (frequency dependent) dielectric function e(wk) of a strongly coupled plasma with the aid of the g-k-s approximation scheme and utilize it for the calculation of the conductivity of strongly coupled plasmas.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0006, INTERACTION OF MONATOMIC AND DIATOMIC MOLECULES WITH SOLID SURFACES
H.Y. WACHMAN, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DF042650; F44620-76-C-0036)

AF function - aerospace vehicles. Deficiency - Air Force flight operations are affected by atmospheric conditions of cloud formation, ice formation on vehicle surfaces or as clouds or precipitation, by fog, and by particle impact damage. Lack of knowledge of aerosol dynamics and of nucleation and growth of ice crystals increases the difficulty of devising ways to achieve all-weather capability in weapons delivery. Objective - to obtain fundamental data in the laboratory which are necessary to complete models of the dynamics and growth of snow and ice in high-altitude clouds and assess the effect of the operation of aerospace vehicles on atmospheric properties, to study in detail some aspects of aerosol dynamics which are of interest to applications to pollutant diffusion. How work contributes - this work will contribute to the understanding of the dynamics of ice particle formation, which is of interest in devising operating procedures effective under all atmospheric conditions. Another use of this information would be to generate an unfavorable environment for hostile reentering vehicles.

Scattering measurements for molecular beams of water molecules impinging upon ice crystal surfaces will be made for a wide range of incident conditions. Target surfaces will be grown in-situ in the vacuum chamber prior to each experiment. Measurements will also be made to distinguish between growth of crystals by surface migration of water molecules and by direct impingement. An analytical model for the kinetics of the nucleating surface under various environmental conditions will be refined, consistent with the experimental results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0007, KONDO SCATTERING STUDIED BY ELECTRON TUNNELING

S. BERMON, City University of New York, School of Liberal Arts & Sci., *Flushing, New York* 11367 (DMR76-17379 A01)

Electron tunneling will be used to study the Kondo effect in metals. By measuring the voltage dependence of the dynamical resistance of metal-insulator-metal tunnel junctions which contain magnetic impurities in one of the metals, one can deduce the energy dependence of the density of states for the impurity. Data from these measurements give much more detailed information about the impurity state than previously available in that, earlier measurements gave only a measure of an average overall energies. Preparation of junctions with the proper atomic species in the proper locations is difficult and the development of sample preparation techniques will be a central part of the research. By measuring the dependence of the resistance peak at zero bias on the distance of the impurity from the oxide interface, the momentum dependence of the exchange coupling constant Jkk' in the s-d model can be determined.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0008, OPTICAL BIREFRINGENCE STUDIES OF LATTICE DEFECTS

J.W. MATTHEWS, Internat. Bus. Machines Corp., *Yorktown Heights, New York* 10598 (DF047790; F49620-77-C-0060)

AF function - solid-state microwave devices are essential components of Air Force command and control, communications and surveillance systems. Deficiency - methods for non-destructive testing microwave materials are inadequate. Objective - it is the objective of this research to develop methods to evaluate non-destructively bulk and epitaxial microwave materials. How work contributes - this research should provide methods to evaluate large crystals before the costly steps of sectioning them into wafers and polishing the wafers are begun and to evaluate electronic devices after each step during processing.

Birefringence techniques will be developed to determine the location and range of dislocations and to study their origin in bulk and epitaxial microwave materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0009, METALS AND ALLOYS

L.D. ROBERTS, Univ. of North Carolina, School of Arts & Sciences, *Chapel Hill, North Carolina* 27514 (DMR75-17924 A02)

Investigations of the electronic properties of metals and alloys previously supported by NSF grant DMR-7307500 A02 will be continued. Metals and alloys will be investigated through the use of a number of closely correlated experimental and theoretical methods. This work will be directed toward gaining more complete information about (a) the alloy wave function in the inner, or core, region of the atoms, (b) the alloy wave function in the immediate vicinity of the alloy atoms, (c) the forces binding the alloy atoms, and (d) toward obtaining a comprehensive theoretical description of some aspects of alloy work in terms of a RAPW pseudopotential treatment. The experimental studies will principally include Mossbauer effect measurements, X-ray chemical shift measurements, and impurity electrical resistance and magnetic studies including Kondo effect measurements. Some of this work will be done at high pressures and at low temperatures. RAPW pseudopotential calculations will be made which will bear primarily on the above. These calculations, however, will also include a correlated theoretical study of thermal diffusion, and a theoretical study of screening at metallic interfaces. Studies will be made predominantly for the Mossbauer elements, Au, Sn, Sb, and Fe, as pure metals, in alloys with each other and with other metals. Type II superconducting alloys of the A-15 structure will be investigated by the above methods as a component of this research program.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0010, MICROWAVE INVESTIGATIONS OF MATTER 14150-P

W. GORDY, Duke University, School of Arts & Sciences, *Durham, North Carolina* 27706 (DA0E9252; DAAG29 77 G0007)

To gain information about the structure and properties of molecules and to develop further the instruments and techniques for generating, detecting and measuring coherent submillimeter wave radiation. Relevance - the program is fundamental to the understanding of laser excited states in gases that operate in the submillimeter region. Consequently, the research is relevant to long-term Army interest in developing millimeter and submillimeter technology for remote sensing.

(1) Continue development of molecular beam maser to higher frequencies using low rotational transitions of simple molecules in the ground vibrational state. (2) Observe rotational transitions of excited vibrational states during pulsed and cw operation as submillimeter lasers. (3) Attempt observation of 'forbidden' transitions of certain symmetric top molecules and non-polar diatomic molecules. (4) Study of rotational spectra of excited vibrational states in simple diatomic and triatomic molecules which vaporize at room temperature. (5) Study unstable molecular species having unpaired electrons. (6) Develop sensitive detectors and harmonic generators for submillimeter operation.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0011, COMMUNICATIONS - CONDUCTIVITY AND OPTICAL EFFECTS IN ANISOTROPIC SEMICONDUCTORS

J.F. SCHETZINA, Univ. of North Carolina, School of Liberal Arts, *Raleigh, North Carolina* 27607 (DN223319; N00014-72-C-0343)

This work on the electrical transport and photovoltaic effect in semiconductors is applicable to the development and improvement of electronic devices, optical switching and electrical instrumentation used by the Navy in its communications operations.

It is proposed to investigate excess carrier transport effects (conductivity due to electrons and holes) in anisotropic semiconductors over a wide temperature range and under varying conditions of photoexcitation. Effects due to stress and variation of light intensity will also be examined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0012, CHARACTERISTICS OF III-V SEMICONDUCTORS

D.C. LOOK, Univ. of Dayton, Graduate School, *Dayton, Ohio* 45409 (DF105310; F33615-76-C-1207)

There is a stated Air Force need for systematic evaluation and characterization of the electronic properties of the materials used in Air Force avionics systems. At present the electronic defect structure, surface and interface properties of these compound semiconductors used for microwave and opto-electronic devices are not well understood. The objectives of this contract are to identify and completely characterize the electronic defect structure of epitaxial and substrate compound semiconductors used in opto-electronic and microwave devices and to investigate the electronic properties associated with the surfaces and interfaces of the materials. Ultimate goal is to solve the material problems that affect the performance of the solid-state devices by conducting a thorough characterization study of materials, processes, and devices.

The objectives of this on-site contractual program will be accomplished by gaining information regarding defect structure of the materials. Shallow or deep impurities and defects will be probed and identified by high-resolution bandgap photoluminescence, near and/or far infrared spectroscopy, and electrical transport measurements. Electron bombardment will be employed to identify intrinsic point lattice defects. The physical position of the traps with respect to the surface or interface will be deduced from c-v measurements, and the trap depth distribution is to be determined by c-v, thermally stimulated conduction (TSC) and thermally stimulated luminescence (TSL) measurements, as applicable for different samples. Spatially resolved photoluminescence and X-ray topographic observations will be used to assist in determining the homogeneity of large samples. The results will be compared with electron irradiated and ion implanted materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

8.0013, FAST OPTICAL SWITCHING IN NARROW-GAP SEMICONDUCTING MATERIALS

A.V. NURMIKKO, Brown University, Graduate School, *Providence, Rhode Island* 02912 (DF046910; AF-AFOSR-3199-77)

AF function - aerospace communications, surveillance and detection systems require electrooptical devices which exploit the special properties and interactions of infrared radiation with solid-state materials. Opportunity - the far infrared region of the electromagnetic spectrum has been virtually unexplored for airborne and satellite applications. Sophisticated electrooptical techniques in narrow band gap compound semiconductors offer promise for optical microcircuity in the 10 to 100 micrometer wavelength range. Objective - this research investigates the optical interactions between infrared radiation and solid-state materials, for the purpose of utilizing the special properties of enhanced transmittances or reflectances induced by optically excited degenerate electron-hole plasmas in such alloys as (HgCd)Te and (PbSn)Te narrow-gap semiconductors. How work contributes - such unique properties could provide suitable materials for fast optical switches, modulators and gates for picosecond infrared pulsed transients and for integrated microcircuity in infrared planar waveguides, optical communications and signal processing.

Suitable optical quality over a wide range of alloy compositions is being sought in narrow band-gap semiconducting materials with controlled compositional homogeneity and doping. The recombination processes and diffusion dynamics which occur at high excess carrier densities are being studied to provide basic understanding of the dynamics of the electron-hole plasmas in these semiconductors. Of particular interest is the coupling of a degenerate carrier gas to phonons and plasma waves in the materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0014, ELECTRONIC STRUCTURE AND STABILITY OF METALLIC GLASSES 13723-P

J. TAUC, Brown University, Graduate School, *Providence, Rhode Island* 02912 (DA0E9132; DAAG29 76 G0221)

Develop theoretical and experimental understanding of the influence of the electron gas on the stability of metallic glasses. Relevance -metallic glasses prepared by fast quenching of some alloys have many valuable properties of technological importance. Among these outstanding characteristics are high strength, ductility, corrosion resistance and simplicity of production. Increased understanding of the mechanisms which control the stability of these and other systems is crucial to the ultimate exploitation of their potential.

A test of the basic assumptions of an electron theory of metallic glasses will be made by a variety of experiments including ultraviolet photoemission, optical properties, magnetic susceptibility, transport properties and inelastic neutron scattering. An attempt will be made to extend the present theory to other classes of alloy systems.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0015, CRYSTALLINE DEFECTS AND THEIR TRANSPORT IN ALKALI AZIDES 13059-P

A.L. LASKAR, Clemson University, School of Phy. Math. & Bio. Sc, *Clemson, South Carolina* 29631 (DA0G5574; DAHC04-75-G-0130)

The primary objective of this research will be towards basic understanding of ionic behavior of alkali azides and the determination of the extent to which this behavior influences the various rate processes and fast reactions. The precise measurements of defect properties and their transport in alkali azides provides information which is directly relatable to metastability. This should lead to development of techniques which will bring about increased safety and the ability to more reliably predict performance of munitions systems.

The following transport studies will be undertaken: self and impurity diffusion of cations and anions in pure and doped crystals; self diffusion of actions in excess pressure of nitrogen to look for effects due to non-stoichiometry; ionic conductivity and ionic thermocurrent measurements in pure and doped crystals.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0016, SURFACE WAVE INVESTIGATION OF SUPERCONDUCTING ALLOYS

M. LEVY, Univ. of Wisconsin, School of Letters & Science, *Madison, Wisconsin* 53706 (DF041820; AF-AFOSR-2893-76)

AF function - superconducting materials are needed for application in airborne multi-megawatt power generation and conditioning systems. Opportunity - research specifically directed toward the synthesis and characterization of high transition temperature metallic compounds can provide a greater margin of design efficiency and operational reliability than presently available superconductors. Objective - this research involves a unique technique, ultrasonic surface waves, to investigate flux pinning, flux flow and AC losses in films of superconducting alloys including A-15 compounds and solution-hardened titanium alloys. How work contributes - the performance of high field magnets and solenoids, electric motor windings, superconducting rotors in power generators and inductive energy storage systems could be significantly improved if AC power distribution losses, transients and mechanical breakdown of the superconductor were reduced.

Ultrasonic surface wave techniques are being used to measure electron phonon interaction and elastic constants while fluxoids are moving as a function of applied magnetic field and electric current. The AC electrical conductivity in the gigahertz frequency range are also measured. In addition surface waves are used to determine any correlation between the superconducting transition temperature of A-15 metallic alloys and compounds, possible structural phase transitions and the amount of hardening occurring in the alloys.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, ANALYSIS OF LUNAR MARE EMPLACEMENT AND IMPACT CRATERING EXPERIMENTS
R. GREELEY, Arizona State University, Graduate School, *Tempe, Arizona* 85281 (NSG 7429)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0002, GENERATION AND BEHAVIOR OF SOLAR SYSTEM MAGNETIC FIELDS
E.H. LEVY, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (NSG 7419)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0003, PIONEER VENUS DATA ANALYSIS OF THE PLASMA ANALYZER EXPERIMENT
D.S. INTRILIGATOR, Univ. of Southern California, School of Letters Arts & Sci., *Los Angeles, California* 90007 (NAS 2-9478)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0004, ULTRAVIOLET OBSERVATIONS OF QUASI-STELLAR OBJECTS
M. SCHMIDT, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (NSG 5244)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0005, THE EFFECT OF H2 AND IRRADIATING WAVELENGTH ON PHOTOCHEMICAL PRODUCTION OF ORGANIC MOLECULES UNDER SIMULATED JOVIAN CONDITIONS
I. KOENIG, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NCA 2-675803)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0006, LIGHT-SCATTERING CALCULATIONS FOR THE NEPHELOMETER EXPERIMENT ON THE 1981/1982 JUPITER ORBITER-PROBE MISSION
G.W. GRAMS, Georgia Inst. of Technology, Graduate School, *Atlanta, Georgia* 30332 (NSG 2306)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0007, ULTRAVIOLET STUDIES OF THE OUTER PLANETS
H.W. MOOS, Johns Hopkins University, School of Arts & Sciences, *Baltimore, Maryland* 21218 (NSG 5255)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0008, ASTRONOMY RESEARCH AT THE FIVE COLLEGE RADIO ASTRONOMY OBSERVATORY
G.R. HUGUENIN, Univ. of Massachusetts, School of Arts & Sciences, *Amherst, Massachusetts* 01002 (AST76-24610 A02)

The Five College Radio Astronomy Observatory will pursue three major projects: 1. The very successful program of pulsar observation will be continued. The behavior of pulsars and their motion through space will be determined in an attempt to characterize the emission mechanism, the rate of formation and other attributes of these unusual, highly condensed objects. The meter wave array used for these observations will be enlarged in order to improve the sensitivity and increase the number of observable objects. 2. The 45-foot, radome enclosed, millimeter telescope will be brought into full scientific operation. It will be used in conjunction with very sensitive maser receivers for studies of the interstellar medium, extragalactic radio sources, and solar system objects.

Development will continue on the application of very low noise maser amplifiers for radio astronomy at millimeter wavelengths. As such receivers become available, they will be put into use on the telescope where it is expected they will provide a ten to fifty-fold increase in sensitivity.

This is a continuation of work previously supported under NSF Grant AST 76-24610.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0009, CHROMOSPHERES OF CLASSIC CEPHEIDS
UNKNOWN, Univ. of Nebraska, Graduate School, *Lincoln, Nebraska* 68508 (NSG 5245)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0010, THEORETICAL STUDIES IN SOLAR PARTICLE PHYSICS
L.A. FISK, Univ. of New Hampshire, Graduate School, *Durham, New Hampshire* 03824 (NSG 7411)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0011, MICROWAVE AND THEORETICAL STUDIES FOR COSMIC BACKGROUND EXPLORER SATELLITE
D.T. WILKINSON, Princeton University, Graduate School, *Princeton, New Jersey* 08540 (NAS 5-24486)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0012, INVESTIGATIONS OF COSMIC X-RAY SOURCES
R. ST. JOHN, Univ. of New Mexico, School of Arts & Sciences, *Albuquerque, New Mexico* 87106 (NCA 5-73)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0013, SOLAR FLARE X-RAY POLARIMETER EXPERIMENT
R. NOVIC, Columbia University, Graduate School, *New York, New York* 10027 (NAS 5-24457)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0014, ULTRAVIOLET OBSERVATIONS OF PLANETS, SATELLITES AND COMETS (INTERNATIONAL ULTRAVIOLET EXPLORER)
T.C. OWEN, State University of New York, School of Arts & Sciences, *Stony Brook, New York* 11790 (NSG 5250)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0015, RESEARCH OF THE ULTRAVIOLET SPECTRUM OF A MASSIVE TRIPLE SYSTEM -OAO
T.J. HERCZEG, Univ. of Oklahoma, School of Arts & Sciences, *Norman, Oklahoma* 73069 (NSG 5257)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0016, POLARIMETRY OF CYGNUS X1 AND RELATED OBJECTS
J.C. KEMP, Oregon State Higher Educ. Sys., School of Liberal Arts, *Eugene, Oregon* 97401 (AST77-23187)

The program of measuring the variable linear polarization of the binary X-ray source Cygnus X1 will be continued. There will also be a program of ultraviolet photometry carried out on this object. High-sensitivity polarimetric observations of binary stars will be made. This will include studies of the polarization at several wavelengths. These polarizations studies can be used for obtaining independent estimates of the orbital inclinations of the binary stars and the transfer of mass within the system. Other objects to be studied will include the Beta Cephei stars and the peculiar A stars.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0017, VELOCITY MODEL OF THE SHALLOW LUNAR CRUST
A.F. GANGI, Texas A & M University System, School of Geosciences, *College Station, Texas* 77843 (NSG 7417)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

GENERAL

11.0001, COLLECTION AND ANALYSIS OF INFORMATION RELATING TO TECHNOLOGY TRANSFER AND APPLICATION
UNKNOWN, Univ. of Denver, Graduate School, *Denver, Colorado* 80210 (NASW 3113)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

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For information on obtaining these films, contact:
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VOLUME 16 NUMBER 16 / AUGUST 23, 1978

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N78-25046*+ National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 95, APRIL 1978
Apr. 1978 114 p
(NASA-SP-7037(95)) Avail: NTIS HC E02 CSCL 01A

This bibliography lists 383 reports, articles, and other documents introduced into the NASA scientific and technical information system in March 1978. Author

N78-25047*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STUDIES OF ADVANCED TRANSPORT AIRCRAFT
A. I. Nagel May 1978 35 p refs Presented at CTOL Transport Technol. Conf., Hampton, Va., 28 Feb. - 3 Mar. 1978. Published in NASA-CP-2036
(NASA-TM-78697; L-12276) Avail: NTIS HC A03/MF A01 CSCL 01C

Concepts for possible future airplanes are studied that include all-wing distributed-load airplanes, multi-body airplanes, a long-range laminar flow control airplane, a nuclear powered airplane designed for towing conventionally powered airplanes during long range cruise, and an aerial transportation system comprised of continuously flying liner airplanes operated in conjunction with short range feeder airplanes. Results indicate that each of these concepts has the potential for important performance and economic advantages, provided certain suggested research tasks are successfully accomplished. Indicated research areas include all-wing airplane aerodynamics, aerial rendezvous, nuclear aircraft engines, air-cushion landing systems, and laminar flow control, as well as the basic research discipline areas of aerodynamics, structures, propulsion, avionics, and computer applications. Author

N78-25048*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
PRECISION POSITIONAL DATA OF GENERAL AVIATION AIR TRAFFIC IN TERMINAL AIR SPACE
W. E. Melson, Jr., L. C. Parker, A. M. Northam (Computer Sciences Corp., Wallops Island, Va.), and R. P. Singh (Computer Sciences Corp., Wallops Island, Va.) May 1978 13 p
(NASA-RP-1020) Avail: NTIS HC A02/MF A01 CSCL 02A

Three dimensional radar tracks of general aviation air traffic at three uncontrolled airports are considered. Contained are data which describe the position-time histories, other derived parameters, and reference data for the approximately 1200 tracks. All information was correlated such that the date, time, flight number, and runway number match the pattern type, aircraft type, wind, visibility, and cloud conditions. Author

N78-25049*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTERACTION OF A TURBULENT-JET NOISE SOURCE WITH TRANSVERSE MODES IN A RECTANGULAR DUCT
George P. Succi (MIT, Cambridge, Mass.), Kenneth J. Baumeister, and K. Uno Ingard (MIT, Cambridge, Mass.) Jun. 1978 42 p refs
(NASA-TP-1248; E-9462) Avail: NTIS HC A03/MF A01 CSCL 20A

A turbulent jet was used to excite transverse acoustic modes in a rectangular duct. The pressure spectrum showed asymmetric singularities (pressure spikes) at the resonant frequencies of the duct modes. This validates previously published theoretical results. These pressure spikes occurred over a range of jet velocities, orientations, and inlet turbulence levels. At the frequency of the spike, the measured transverse pressure shape matched the resonant mode shape. Author

N78-25050# Arinc Research Corp., Annapolis, Md.
LOGISTICS AND OPERATIONAL EFFECTIVENESS OF THE P-3 AIRCRAFT Final Summary Report
Mar. 1978 37 p
(Contract N00019-77-C-0309)
(AD-A052239; Rept-1701-01-1-1728) Avail: NTIS HC A03/MF A01 CSCL 01/3

This report summarizes a 12-month logistics, engineering, and program analysis effort performed by ARINC Research Corporation for the Naval Air Systems Command. It describes the activities that provided the P-3 Project Manager with an independent and objective evaluation of factors affecting the P-3's operational availability and logistic support posture. The effort consisted primarily of analysis tasks for the major P-3 modification programs, integrated logistic support, foreign military sales programs, operational readiness programs, and P-3 site transition programs. Author (GRA)

N78-25051# Administrative Sciences Corp., Alexandria, Va.
NAVAL AIRCRAFT OPERATING AND SUPPORT COST MODEL - FISCAL YEAR 1976 REVISION
Mar. 1978 84 p
(Contract N00014-77-C-0180)
(AD-A053180; ASC-R-116) Avail: NTIS HC A05/MF A01 CSCL 01/3

This report documents the revisions of a parametric model for estimating Naval aircraft operating and support costs developed by Administrative Sciences Corporation. The model provides an estimate of average annual and life cycle O and S costs based on aircraft physical characteristics and basic program parameters using parametric cost-estimating relationships, cost factors and throughputs, and has been used to support numerous cost analyses prepared for CAIG review as well as other special studies such as the Naval Escort Force Mix Study and the Sea Based Air Study. It is updated often in order to remain responsive to each particular analysis, to reflect the changing nature of Naval aviation, and simply to remain timely. This report reflects the status of the model after incorporation of all FY1976 data. The bulk of the report is concerned with providing a clear, concise and complete definition of each cost element and the way it is estimated by the model. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N78-25052*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MEASUREMENTS IN THE TURBULENT BOUNDARY LAYER AT CONSTANT PRESSURE IN SUBSONIC AND SUPERSONIC FLOW. PART 1: MEAN FLOW Final Report, May 1975 - Feb. 1978
Donald J. Collins, Donald E. Coles, and John W. Hicks May 1978 221 p refs
(Contracts NAS7-100; F44620-75-C-0007; MIPR EY-7483-76-0003; MIPR EY-7483-76-0009)
(NASA-CR-156989; JPL-Pub-78-23; AEDC-TR-78-21-Pt-1) Avail: NTIS HC A10/MF A01 CSCL 01A

Experiments were carried out to test the accuracy of laser Doppler instrumentation for measurement of Reynolds stresses in turbulent boundary layers in supersonic flow. Two facilities were used to study flow at constant pressure. In one facility, data were obtained on a flat plate at M sub e = 0.1, with Re theta up to 8,000. In the other, data were obtained on an adiabatic nozzle wall at M sub e = 0.6, 0.8, 1.0, 1.3, and 2.2, with Re theta = 23,000 and 40,000. The mean flow as observed using Pitot tube, Preston tube, and floating element instrumentation is described. Emphasis is on the use of similarity laws with Van Driest scaling and on the inference of the shearing stress profile and the normal velocity component from the equations of mean motion. The experimental data are tabulated. Author

N78-25053*# Old Dominion Univ., Norfolk, Va.
SIDE-FORCE ALLEVIATION ON SLENDER, POINTED FOREBODIES AT HIGH ANGLES OF ATTACK
Dhanvada M. Rao May 1978 25 p refs
(Grant NsG-1315)
(NASA-CR-145361) Avail: NTIS HC A02/MF A01 CSCL 01A

A new device was proposed for alleviating high angle-of-attack side force on slender, pointed forebodies. A symmetrical pair of separation strips in the form of helical ridges are applied to the forebody to disrupt the primary lee-side vortices and thereby avoid the instability that produces vortex asymmetry. Preliminary wind tunnel tests at Mach 0.3 and Reynolds no. 5,250,000 on a variety of forebody configurations and on a wing-body combination at angles of attack up to 56 degrees, demonstrated the effectiveness of the device. Author

N78-25054*# Vought Corp., Hampton, Va.
PANELING TECHNIQUES FOR USE WITH THE VORLAX COMPUTER PROGRAM
Glenn L. Martin Apr. 1978 23 p ref
(Contract NAS1-13500)
(NASA-CR-145364) Avail: NTIS HC A02/MF A01 CSCL 01A

A method is presented for determining the geometric input data required by the VORLAX computer program in order to accurately model an aircraft configuration. Techniques are described for modeling each of the major components of a configuration and for joining these individual components into a complete configuration. The effects of trailing vortex filaments and methods of avoiding their intersection with downstream panels are also discussed. The methods presented here are applicable to most conventional aircraft configurations. Author

N78-25055*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
FLIGHT-MEASURED PRESSURE CHARACTERISTICS OF AFT-FACING STEPS IN HIGH REYNOLDS NUMBER FLOW AT MACH NUMBERS OF 2.20, 2.50, AND 2.80 AND COMPARISON WITH OTHER DATA
Sheryll Goecke Powers May 1978 38 p refs
(NASA-TM-72855; H-956) Avail: NTIS HC A03/MF A01 CSCL 01A

The YF-12 airplane was studied to determine the pressure characteristics associated with an aft-facing step in high Reynolds number flow for nominal Mach numbers of 2.20, 2.50, and 2.80. Base pressure coefficients were obtained for three step heights. The surface static pressures ahead of and behind the step were measured for the no-step condition and for each of the step heights. A boundary layer rake was used to determine the local boundary layer conditions. The Reynolds number based on the length of flow ahead of the step was approximately 10 to the 8th power and the ratios of momentum thickness to step height ranged from 0.2 to 1.0. Base pressure coefficients were compared with other available data at similar Mach numbers and at ratios of momentum thickness to step height near 1.0. In addition, the data were compared with base pressure coefficients calculated by a semiempirical prediction method. The base pressure ratios are shown to be a function of Reynolds number based on momentum thickness. Profiles of the surface pressures ahead of and behind the step and the local boundary layer conditions are also presented. Author

N78-25056*# Polytechnic Inst. of New York. Aerodynamics Labs.
A FINITE-STEP METHOD FOR ESTIMATING THE SPANWISE LIFT DISTRIBUTION OF WINGS IN SYMMETRIC, YAWED, AND ROTARY FLIGHT AT LOW SPEEDS Final Report
A. R. Krenkel Jun. 1978 107 p refs
(Grants NsG-1107; NsG-1300)
(NASA-CR-157043; Poly-M/AE-78-17) Avail: NTIS HC A06/MF A01 CSCL 01A

The finite-step method was programmed for computing the span loading and stability derivatives of trapezoidal shaped wings in symmetric, yawed, and rotary flight. Calculations were made for a series of different wing planforms and the results compared with several available methods for estimating these derivatives in the linear angle of attack range. The agreement shown was generally good except in a few cases. An attempt was made to estimate the nonlinear variation of lift with angle of attack in the high alpha range by introducing the measured airfoil section data into the finite-step method. The numerical procedure was found to be stable only at low angles of attack. Author

N78-25057*# Nielsen Engineering and Research, Inc., Mountain View, Calif.
HIGH ANGLE CANARD MISSILE TEST IN THE AMES 11-FOOT TRANSONIC WIND TUNNEL
Richard G. Schwind Jun. 1978 81 p refs
(Contract NAS2-9211)
(NASA-CR-2993; NEAR-TR-134) Avail: NTIS HC A05/MF A01 CSCL 01A

Four blunted ogive-cylinder missile models with a length-to-diameter ratio of 10.4 were tested at transonic speeds and large angles of attack. The configurations are: body, body with tail panels, body with canards, and body with canards and tails. Forces and moments from the entire model and each of the eight fins were measured over the pitch range of 20 deg to 50 deg and 0 deg to 45 deg roll. Canard deflection angles between 0 deg and 15 deg were tested. Exploratory vapor screen flow visualization testing was also performed. Sample force and moment data are reported along with observations from the vapor screen tests. Author

N78-25058*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A DISTRIBUTED VORTEX METHOD FOR COMPUTING THE VORTEX FIELD OF A MISSILE
Raymond L. Barger Jun. 1978 19 p refs
(NASA-TP-1183; L-11963) Avail: NTIS HC A02/MF A01 CSCL 01A

Vortex sheet development in the flow field of a missile was investigated by approximating the sheets in the cross-flow plane with short straight-line segments having distributed vorticity. In contrast with the method that represents the sheets as lines of discrete vortices, this distributed vortex method produced calculations with a high degree of computational stability.Author

N78-25059*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC CHARACTERISTICS AT MACH NUMBER

0.2 OF A WING-BODY CONCEPT FOR A HYPERSONIC RESEARCH AIRPLANE
James L. Dillon and Theodore R. Creel, Jr. Jun. 1978 48 p refs
(NASA-TP-1189; L-12063) Avail: NTIS HC A03/MF A01 CSCL 01A

The static aerodynamic characteristics were studied on a model wing-body concept for a high-speed research airplane in a low-turbulence pressure tunnel. The experiment consisted of configuration buildup from the basic body by adding a wing, center vertical tail, three-module scramjet, and six-module scramjet engine. The test Mach number was 0.2 at Reynolds numbers, based on fuselage length, ranging from 2.78 x 1 million to 23 x 2 million. The test angle-of-attack range was approximately -5 to 30 deg at constant angles of sideslip of 0 deg and 4 deg. The elevons were deflected from 5 deg to -15 deg. Roll and yaw control were investigated. Author

N78-25060*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF SPANWISE NOZZLE GEOMETRY AND LOCATION ON THE LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF A VECTORED-ENGINE-OVER-WING CONFIGURATION AT SUBSONIC SPEEDS
Laurence D. Leavitt and Long P. Yip May 1978 78 p refs
(NASA-TP-1215; L-12015) Avail: NTIS HC A05/MF A01 CSCL 01A

A V/STOL tunnel study was performed to determine the effects of spanwise blowing on longitudinal aerodynamic characteristics of a model using a vectored-over-wing powered lift concept. The effects of spanwise nozzle throat area, internal and external nozzle geometry, and vertical and axial location were investigated. These effects were studied at a Mach number of 0.186 over an angle-of-attack range from 14 deg to 40 deg. A high pressure air system was used to provide jet-exhaust simulation. Engine nozzle pressure ratio was varied from 1.0 (jet off) to approximately 3.75. Author

N78-25061*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A WIND-TUNNEL STUDY OF THE APPLICABILITY OF FAR-FIELD SONIC-BOOM THEORY TO THE SPACE SHUTTLE ORBITER
Harry W. Carlson and Robert J. Mack Jun. 1978 48 p refs
(NASA-TP-1186; L-12051) Avail: NTIS HC A03/MF A01 CSCL 01A

Sonic boom characteristics of a 0.0004-scale model of the space shuttle orbiter were studied. Pressure signatures were measured at Mach numbers of 2.8 and 4.14 and at angles of attack of 0.3 deg, 19.0 deg, and 41.0 deg. To allow for observation of signature development and to provide data for extrapolation to larger distances, measurements were made at distances of from 8 to 32 body lengths. Relatively simple purely theoretical prediction methods provided reasonably accurate estimates of bow-shock overpressure and signature impulse. Author

N78-25062# DCW Industries, Studio City, Calif.
RESEARCH ON THE POST-CRITICAL STAGES OF TRANSITION Final Technical Report, 1 Mar. 1977 - 31 Jan. 1978
David C. Wilcox Jan. 1978 44 p refs
(Contract N00014-77-C-0259; RR0310181)
(AD-A053286; DCW-R-18-01; ONR-CR-289-020-1F) Avail: NTIS HC A03/MF A01 CSCL 20/4

Linear-stability computations for the Blasius boundary layer have been performed in order to evaluate closure coefficients appearing in the Wilcox-Traci two-equation model of turbulence. The computations show that the key closure coefficient affecting the model's ability to accurately predict transition, lambda, is strongly frequency dependent until a given boundary-layer disturbance has been amplified to about (e to the 4th power) times its initial value. Beyond this point, lambda approaches an asymptotic profile which is independent of frequency, provided the boundary layer is unstable. Although further investigation is needed, results show promise that a sound, physically-founded synthesis of linear-stability and turbulence-model methods is possible. Author (GRA)

N78-25063# ARO, Inc., Arnold Air Force Station, Tenn.
AEDC HIGH-TEMPERATURE TESTING CAPABILITIES Final Report, Dec. 1976 - May 1977
M. H. Trimble, R. T. Smith, and R. K. Matthews AEDC Apr. 1978 109 p
(AD-A053150; AEDC-TR-78-3) Avail: NTIS HC A06/MF A01 CSCL 20/4

Testing of equipment and materials at elevated temperatures, requires facilities with special features and capabilities. This report summarizes the AEDC high-temperature facilities testing capability, discussing both the present and future capabilities of existing test units. Adequate information is included to define the thermal, pressure, velocity, and geometrical boundaries. These parameters are indicative of a capability; however, for test planning purposes, a potential user should contact AEDC for an evaluation of requirements, selection of the most suitable facility, scheduling, and costs. Author (GRA)

N78-25064# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT OF A PARACHUTE RECOVERY SYSTEM FOR A REENTRY NOSE CONE (NRV)
W. B. Pepper Sep. 1977 41 p refs
(Contract EY-76-C-04-0789)
(SAND-75-0564) Avail: NTIS HC A02/MF A01

A two-stage parachute system consisting of a 19-in. dia ribbon parachute and a 3-ft dia guide surface parachute which is deployed 1.9 s after initial deployment is described. A 1.25 ft 3 ram air-filled flotation bag with radio beacon is used for ocean recovery of the 40-lb nose cone. Recovery was initiated by jettisoning 60 percent of the initial reentry mass prior to parachute deployment. ERA

N78-25065# National Technical Information Service, Springfield, Va.
TRACKED AIR CUSHION VEHICLES AND MAGNETIC LEVITATION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Feb. 1978
Guy E. Habercom, Jr. Mar. 1978 285 p Supersedes NTIS/PS-77/0179
(NTIS/PS-78/0266; NTIS/PS-77/0179) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 01A

The feasibility, design, and track dynamics of tracked air cushioned and magnetically levitated vehicles are investigated in these abstracts of reports gathered in a worldwide literature survey. GRA

N78-25066# National Technical Information Service, Springfield, Va.
TRACKED AIR CUSHION VEHICLE AND MAGNETIC LEVITATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Feb. 1978
Guy E. Habercom, Jr. Mar. 1978 132 p Supersedes NTIS/PS-77/01278; NTIS/PS-76/0094; NTIS/PS-75/114
(NTIS/PS-78/0265; NTIS/PS-77/0178; NTIS/PS-76/0094; NTIS/PS-75/114) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 01A

For abstract, see N78-25065.

N78-25067# National Technical Information Service, Springfield, Va.
PARACHUTES AND DECELERATORS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1974 - Mar. 1978
Guy E. Habercom, Jr. Apr. 1978 286 p Supersedes NTIS/PS-77/0317; NTIS/PS-76/0259 and NTIS/PS-75/224
(NTIS/PS-78/0320; NTIS/PS-77/0317; NTIS/PS-76/0259; NTIS/PS-75/224) Avail: NTIS HC $28.00/MF $28.00 CSCL 01C

Citations describe devices such as towplates, ballutes, servoactuators, patented mechanisms, semiautomatic openers, and release systems. This document discusses inflatable, supersonic, autorotor, retrorocket, and other structures. Descent characteristics, trajectories, aerodynamic reefing, shroud line and snatch forces, and flare engineering are included. Also presented are materials on flight testing, models, wind tunnel tests, and computer aided design. Applications are to target drone retrieval, air drop and delivery, coastal upwelling, sewage water tracking, and mine ventilation. GRA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N78-25068*# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
SURVEY OF AIR CARGO FORECASTING TECHNIQUES Final Report
A. R. Kuhlthan and R. S. Vermuri May 1978 159 p refs
(Contract NAS1-14908)
(NASA-CR-145329; UVA/528156/CE78/110) Avail: NTIS HC A08/MF A01 CSCL 05A

Forecasting techniques currently in use in estimating or predicting the demand for air cargo in various markets are discussed with emphasis on the fundamentals of the different forecasting approaches. References to specific studies are cited when appropriate. The effectiveness of current methods is evaluated and several prospects for future activities or approaches are suggested. Appendices contain summary type analyses of about 50 specific publications on forecasting, and selected bibliographies on air cargo forecasting, air passenger demand forecasting, and general demand and modalsplit modeling.
Author

N78-25069*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRELIMINARY ANALYSIS OF HUB AND SPOKE AIR FREIGHT DISTRIBUTION SYSTEM
Allen H. Whitehead, Jr. Apr. 1978 36 p refs
(NASA-TM-72656) Avail: NTIS HC A03/MF A01 CSCL 01C

A brief analysis is made of the hub and spoke air freight distribution system which would employ less than 15 hub centers world wide with very large advanced distributed-load freighters providing the line-haul delivery between hubs. This system is compared to a more conventional network using conventionally-designed long-haul freighters which travel between numerous major airports. The analysis calculates all of the transportation costs, including handling charges and pickup and delivery costs. The results show that the economics of the hub/spoke system are severely compromised by the extensive use of feeder aircraft to deliver cargo into and from the large freighter terminals. Not only are the higher costs for the smaller feeder airplanes disadvantageous, but their use implies an additional exchange of cargo between modes compared to truck delivery. The conventional system uses far fewer feeder airplanes, and in many cases, none at all. When feeder aircraft are eliminated from the hub/spoke system, however, that system is universally more economical than any conventional system employing smaller line-haul aircraft.
Author

N78-25070*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
HIGH VISIBILITY AIR SEA RESCUE PANEL Patent Application
Jack Naimer and Mathew I. Radnofsky, inventors (to NASA) Filed 16 Dec. 1977 10 p
(NASA-Case-MSC-12564-2; US-Patent-Appl-SN-861389) Avail: NTIS HC A02/MF A01 CSCL 06G

A system for air sea rescue was developed utilizing a thin film, large area, easily deployable, highly visible, buoyant panel which was formed of a substrate having a specific gravity less than sea water and impregnated with a brilliant fluorescent pigment. The panel may be accordion folded for compactness and ease of deployment, may have an inflatable periphery to enhance deployment, rigidity, and buoyancy and may include means for attachment to a floatation device.
NASA

N78-25071*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASA AVIATION SAFETY REPORTING SYSTEM Quarterly Report, 1 Apr. - 30 Jun. 1977
Apr. 1978 62 p Prepared in cooperation with Battelle Columbus Labs., Mountain View, Calif.
(NASA-TM-78476; A-7373; QR-5) Avail: NTIS HC A04/MF A01 CSCL 02A

Reports describing various types of communication problems are presented along with summaries dealing with judgment and decision making. Concerns relating to the ground proximity warning system are summarized and several examples of true terrain proximity warnings are provided. An analytic study of reports relating to profile descents was performed. Problems were found to be associated with charting and graphic presentation of the descents, with lack of uniformity of the descent procedures among facilities using them, and with the flight crew workload engendered by profile descents, particularly when additional requirements are interposed by air traffic control during the execution of the profiles. A selection of alert bulletins and responses to them were reviewed.
Author

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N78-25072# SRI International Corp., Arlington, Va.
FORECAST AND ANALYSIS OF INTERNATIONAL AIR TRAFFIC IN RELATION TO TRANSOCEANIC COMMUNICATION REQUIREMENTS, APPENDIX 1
Randall Pozdena, James Gorham, Dorothea Gross, and Dennis Yee Dec. 1977 55 p
(Contract DOT-FA75WA-3574-1)
(AD-A052804; FAA-RD-77-131-1; MSU-4004) Avail: NTIS HC A04/MF A01 CSCL 01/2

Data used for forecasting and analyzing air traffic activity for the Atlantic, Pacific and Indian Ocean basins are presented. Contents include: (1) world area code lists showing breakout of countries by Official Airline Guide world area codes; (2) income and demographic growth rates for selected countries in the Atlantic, Pacific and Indian Ocean basins; (3) high and low global interregional traffic forecasts of annual and busy day flight frequencies for passenger and cargo segments covering 1972, 1975 with forecasts for 1980-1995; (4) instantaneous airborne counts by subzones; (5) total number of flights for all stage lengths contributing to the busy basin day, for the base year 1975, for each Atlantic basic Instantaneous Airborne Count area by route segment regional origin-destination pair.
Author

N78-25073# SRI International Corp., Arlington, Va.
FORECAST AND ANALYSIS OF INTERNATIONAL AIR TRAFFIC IN RELATION TO TRANSOCEANIC COMMUNICATION REQUIREMENTS, APPENDIX 2
Randall Pozdena, Dorothea Gross, James Gorham, and Dennis Yee Dec. 1977 100 p refs
(Contract DOT-FA75WA-3574-1)
(AD-A052808; MSU-4004; FAA-RD-77-131-2) Avail: NTIS HC A05/MF A01 CSCL 01/2

An extensive description is provided of the methodology and assumptions used in developing the air traffic activity forecasting system. Described are assumptions concerning the future market environment of aviation, the forecasting system developed to estimate levels of air traffic and derive peak instantaneous airborne counts, and the results of tests conducted to assess the effects of changing parameter assumptions on the forecast results.
Author

N78-25074# Texas Univ., Austin. Applied Mechanics Research Lab.
GLOBAL POSITIONING SYSTEM NAVIGATION ALGORITHMS Final Report, 1 Apr. 1976 - 31 Aug. 1977
Leonard Richard Kruczynski May 1977 330 p refs
(Contract F04701-76-C-0090)
(AD-A052747; AMRL-1079; SAMSO-TR-78-57) Avail: NTIS HC A15/MF A01 CSCL 17/7

The Global Positioning System (GPS) will be a constellation of 24 satellites placed in 12-hour, 63 degree inclination, circular orbits. The satellite configuration is designed to provide accurate three-dimensional position, velocity, and time information by transmitting signals from which users can extract range and range-rate measurements. This investigation describes the passive-ranging concept of the system and the various hardware, software, and environmental factors which determine system accuracy. The simulation of a New York-to-Chicago aircraft flight with satellite range and range-rate measurements and with barometric altimeter measurements is used to numerically evaluate navigation algorithms. The satellite configuration used in the simulation is the limited operational configuration which consists of only nine satellites. For 95 percent of the simulated flight, only three satellites are visible to the user. The search for acceptable navigation algorithms begins with a review of a linear filtering and prediction theory. A filter model for the aircraft is developed based on the assumption of an exponentially correlated random acceleration. The resulting model, combined with measurement bias models, is incorporated into an extended Kalman filter. Numerical results show that, for the basic filter model, filters which maintain good accuracy during the maneuvering phases of flight have poor performance during cruising flight, and conversely, filters which perform well during cruise, have degraded accuracy during maneuvers. GRA

N78-25075# National Ocean Survey, Rockville, Md.
UNITED STATES COAST PILOT 1, ATLANTIC COAST: EASTPORT TO CAPE COD, 14TH EDITION
Jan. 1978 297 p
(PB-278137; NOAA-78022401) Avail: NTIS HC A13/MF A01 CSCL 17G

Local and weekly notices to Mariners issued by the Coast Guard and the Defense Mapping Agency Hydrographic Center by November 1977 were used to correct data in this edition of the Coast Pilot. Navigational information based on field observations and shown on nautical charts is supplemented for the following areas: Eastport to Cape Cod; Quoddy Narrows to Calais, Maine; Quoddy Narrows to Petit Manan Island, Maine; Petit Manan Island to Jerico Bay, Maine; Jerico Bay to Penobscot Bay, Maine; Muscongus Bay to Cape Elizabeth, Maine; Cape Elizabeth to Cape Ann, Massachusetts; Cape Ann to Boston Harbor, Massachusetts; Boston Harbor, Massachusetts; and Minots Ledge to Provincetown, Mass. Author

N78-25076# National Ocean Survey, Rockville, Md.
UNITED STATES COAST PILOT 2, ATLANTIC COAST: CAPE COD TO SANDY HOOK, 13TH EDITION
Jan. 1978 291 p
(PB-278138; NOAA-78022202) Avail: NTIS HC A13/MF A01 CSCL 17G

Navigation information shown on nautical charts and based upon field inspections is supplemented by this updated Coast pilot which describes the following areas: Cape Cod to Sandy Hook; Outer Cape Cod and Nantucket Sound; Vinyard Sound and Buzzards Bay; Narragansett Bay; Block Island Sound; Eastern Long Island Sound; Western Long Island Sound; South Coast of Long Island; New York Harbor; and Hudson River. Author

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N78-25077# Nationaal Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).
A NON-STATIONARY MODEL FOR ATMOSPHERIC TURBULENCE PATCHES FOR THE PREDICTION OF AIRCRAFT DESIGN LOADS
R. Noback 19 Nov. 1976 67 p refs
(NLR-TR-76131-U; ICAF-999) Avail: NTIS HC A04/MF A01

A model for atmospheric turbulence is proposed. It is assumed that atmospheric turbulence appears in patches and that within the patches the turbulence can be described as a modulated Gaussian process. Statistical properties of the model and of atmospheric turbulence are compared. Using data from various sources a probability distribution function for patch lengths was derived and the relation between patch intensity and patch length was investigated. Author

N78-25078*# Kansas Univ. Center for Research, Inc., Lawrence.
A STUDY OF COMMUTER AIRPLANE DESIGN OPTIMIZATION Status Report
Bob Van Keppel, Han Eysink, Jim Hammer, Kevin Hawley, Paul Meredith, and J. Roskam 12 May 1978 457 p refs
(Grant NsG-2145)
(NASA-CR-157210; KU-FRL-313-5; SR-4) Avail: NTIS HC A20/MF A01 CSCL 01C

The usability of the general aviation synthesis program (GASP) was enhanced by the development of separate computer subroutines which can be added as a package to this assembly of computerized design methods or used as a separate subroutine program to compute the dynamic longitudinal, lateral-directional stability characteristics for a given airplane. Currently available analysis methods were evaluated to ascertain those most appropriate for the design functions which the GASP computerized design program performs. Methods for providing proper constraint and/or analysis functions for GASP were developed as well as the appropriate subroutines. A.R.H.

N78-25079*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRELIMINARY STUDY OF A LARGE SPAN-DISTRIBUTED-LOAD FLYING-WING CARGO AIRPLANE CONCEPT
Lloyd S. Jerneli May 1978 105 p refs
(NASA-TP-1158; L-11943) Avail: NTIS HC A06/MF A01 CSCL 01C

An aircraft capable of transporting containerized cargo over intercontinental distances is analyzed. The specifications for payload weight, density, and dimensions in essence configure the wing and establish unusually low values of wing loading and aspect ratio. The structural weight comprises only about 18 percent of the design maximum gross weight. Although the geometric aspect ratio is 4.53, the winglet effect of the wing-tip-mounted vertical tails, increase the effective aspect ratio to approximately 7.9. Sufficient control power to handle the large rolling moment of inertia dictates a relatively high minimum approach velocity of 315 km/hr (170 knots). The airplane has acceptable spiral, Dutch roll, and roll-damping modes. A hardened stability augmentation system is required. The most significant noise source is that of the airframe. However, for both take-off and approach, the levels are below the FAR-36 limit of 108 db. The design mission fuel efficiency is approximately 50 percent greater than that of the most advanced, currently operational, large freighter aircraft. The direct operating cost is significantly lower than that of current freighters, the advantage increasing as fuel price increases. Author

N78-25080*# Sikorsky Aircraft, Stratford, Conn.
OIL-AIR MIST LUBRICATION FOR HELICOPTER GEARING Final Report
F. McGrogan Dec. 1976 52 p refs
(Contract NAS3-18538)
(NASA-CR-135081; SER-50959) Avail: NTIS HC A04/MF A01 CSCL 01C

The applicability of a once-through oil mist system to the lubrication of helicopter spur gears was investigated and compared to conventional jet spray lubrication. In the mist lubrication mode, cooling air was supplied at 366K (200 F) to the out of mesh location of the gear sets. The mist air was also supplied at 366K (200 F) to the radial position mist nozzle at a constant rate of 0.0632 mol/s (3 SCFM) per nozzle. The lubricant contained in the mist air varied between 32 - 44 cc/hour. In the recirculating jet spray mode, the flow rate was varied between 1893 - 2650 cc/hour. Visual inspection revealed the jet spray mode produced a superior surface finish on the gear teeth but a thermal energy survey showed a 15 - 20% increase in heat generated. The gear tooth condition in the mist lubrication mode system could be improved if the cooling air and lubricant/air flow ratio were increased. The test gearbox and the procedure used are described. Author

N78-25081# Kaman Avidyne, Burlington, Mass.
MODELING OF THE UH-1B TAIL BOOM FOR ANALYSIS BY THE NASTRAN COMPUTER PROGRAM Final Report, 19 Apr. - 19 Oct. 1976
Raffi P. Yeghiayan Feb. 1978 52 p
(Contract DAAD05-76-C-0763)
(AD-A052303; KA-TR-139; ARBRL-CR-00358) Avail: NTIS HC A04/MF A01 CSCL 01/3

A representative tail boom of the UH-1B helicopter is modeled for dynamic structural analysis by the NASTRAN computer program. The finite-element model employs beam and plate elements to construct the structural model, which will subsequently be used to study the effects of simulated nuclear detonations, subjecting the model to blast overpressure exposure with and without thermal effects. The lower mode shapes and frequencies of the structural model are generated and presented as a validation check. Author (GRA)

N78-25082# Cleveland Pneumatic Tool Co., Ohio.
GRAPHITE COMPOSITE LANDING GEAR COMPONENT: UPPER DRAG BRACE HARDWARE FOR F-15 AIRCRAFT Final Report, Jul. 1975 - Jan. 1977
Myron J. Bieber and Walter W. Fricker Sep. 1977 160 p
(Contract F33615-75-C-3152; AF Proj. 1369)
(AD-A052764; AFFDL-TR-77-88) Avail: NTIS HC A06/MF A01 CSCL 01/3

This report summarizes work performed to design, fabricate and test a graphite epoxy composite material upper drag brace suitable for direct replacement of the current titanium upper drag brace for the F-15 aircraft landing gear assembly. Design, fabrication, test procedures, test results, and failure analysis are presented in detail. The composite material brace failed at less than design load. The program established, at the present time, that drag braces and similar landing gear hardware can not be satisfactorily fabricated from graphite epoxy material for use as a direct replacement of existing metallic hardware in some applications. The volume and shape of available space in these direct replacement applications does not normally allow the use of optimum graphite epoxy material design and fabrication techniques. However, as demonstrated by the successful development of a graphite epoxy side brace suitable for direct replacement of existing metallic hardware on the A-37B aircraft, weight and cost saving applications to current aircraft are feasible. Therefore, each potential application must be individually evaluated. Work is required to improve analytical, fabrication and nondestructive inspection techniques for graphite epoxy materials. It can be reasonably expected that current and future efforts by the Air Force, industry and the educational community, aimed at these improvements, will increase the profitable application of graphite epoxy material to landing gear hardware. Author (GRA)

N78-25083# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN INVESTIGATION OF THE TRACKING PERFORMANCE OF THE FIRE FLY MANUAL DIRECTOR GUNSIGHT FOR AIR-TO-AIR GUNNERY M.S. Thesis
David L. Frostman Dec. 1977 179 p refs
(AD-A053348; AFIT/GGC/EE/77-5) Avail: NTIS HC A09/MF A01 CSCL 19/5

The tracking performance of the Fire Fly manual director gunsight is evaluated during the terminal phase of air-to-air gunnery using the F-106 aircraft as the test bed. A digital simulation of the closed loop tracking task is performed. The multi-axis analytical pilot model is adapted for use in the F-106/Fire Fly gunsight simulation. A set of nominal pilot model parameter values, determined by root locus analysis, is used in simulating the tracking performance of the Fire Fly gunsight against targets in constant altitude, constant airspeed, constant rate turns at bank angles of 30, 60, and 70 degrees. The tracking error responses are found to have characteristics similar to those observed in the tracking responses obtained from man-in-the-loop simulation studies. The dependence of the tracking error responses on the pilot model parameter values is demonstrated by simulation runs in which several pilot model parameter values are varied. GRA

N78-25084# Naval Air Test Center, Patuxent River, Md.
ENVIRONMENTAL REQUIREMENTS FOR SIMULATED HELICOPTER/VTOL OPERATIONS FROM SMALL SHIPS AND CARRIERS
C. W. Woomer and R. L. Williams 12 Apr. 1978 35 p refs
(AD-A053078; NATC-TM-78-2-RW) Avail: NTIS HC A03/MF A01 CSCL 05/9

Helicopter/VTOL operations from ships create demanding flying qualities and performance requirements. The environment in which takeoff and landing evolutions must occur has a significant influence on these tasks. Aircraft and simulator designers, each in their own way, must make appropriate provisions for environmental factors, such as visual landing aids (VLA), ship motion, turbulence, relative wind, and ground effect. The paper discusses the specific requirements for the simulated environment to satisfactorily provide training for shipboard takeoff and landing. Test techniques to validate trainer fidelity in flying qualities, performance, and environmental simulation are discussed. The specific subject of calligraphic visual systems is extensively covered, including a report on the current state-of-the-art as related to the at-sea environment. Finally, the utilization of a high-fidelity trainer is explored for research as well as for expanded fleet training. GRA

N78-25085# Grumman Aerospace Corp., Bethpage, N.Y.
DEMONSTRATION OF ACOUSTIC EMISSION SYSTEM FOR DAMAGE MONITORING OF FULL SCALE METALLIC AIRCRAFT STRUCTURES DURING FATIGUE TESTING Final Report, Aug. 1976 - Jul. 1977
Alan D. Hencken and Charles R. Horak Sep. 1977 82 p
(Contract F33615-76-C-3073)
(AD-A053108; AFFDL-TR-77-87) Avail: NTIS HC A05/MF A01 CSCL 01/3

This report describes the acoustic emission monitoring work performed on a full scale metallic aircraft wing carry through structure of the swing wing bomber type. The structure was monitored during fatigue testing with a Grumman developed system. The program was designed to prove the feasibility of using a real time acoustic emission monitoring system to detect and locate crack propagation in a full scale complex airframe structure during fatigue cycling. The report includes a description of the Acoustic Emission System operation and the concepts of noise discrimination used on fatigue tests. The installation and monitoring techniques used on the fatigue test are described. The test results, the problems associated with monitoring the complex structure, the conclusions, and system monitoring recommendations are also discussed in this report. Author (GRA)

N78-25086# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
TEST OPERATIONS PROCEDURES PHYSICAL CHARACTERISTICS AVIATION MATERIAL
Roy L. Miller 29 Nov. 1977 15 p Supersedes the aviation portions of TOP-1-3-5
(AD-A053196; TOP-7-3-500; TOP-1-3-5) Avail: NTIS HC A02/MF A01 CSCL 15/5

This document identifies testing methods and techniques necessary to determine the degree to which Army aviation materiel's physical characteristics are determined. Author (GRA)

N78-25087# Rockwell International Corp., Los Angeles, Calif.
PRELIMINARY DESIGN OF LOW-COST TITANIUM STRUCTURE Final Report, Apr. 1976 - Sep. 1977
J. K. Pulley Sep. 1977 160 p refs
(Contract F33615-76-C-3066)
(AD-A053327; NA-77-389; AFFDL-TR-77-81) Avail: NTIS HC A08/MF A01 CSCL 01/3

Results of a study program to evaluate the application of advanced titanium fabrication techniques to the Air Force B-1 bomber engine nacelle structure for improvements in cost and weight are presented. There are five items for the study. Two of them are primary structure, one of which is a removable access panel. The remaining three items are secondary structure. Superplastic forming with concurrent diffusion bonding, including expanded sandwich, were investigated. Weight savings range up to 49 percent. Potential weight savings are 362 pounds per aircraft. Cost savings range up to 69 percent, resulting in a

potential savings of up to $48,622,800 for 240 aircraft.
Author (GRA)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N78-25088*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
AIR SPEED AND ATTITUDE PROBE Patent Application
Merle A. Economu, inventor (to NASA) Filed 30 May 1978 13 p
(NASA-Case-FRC-11009-1; US-Patent-Appl-SN-910708) Avail: NTIS HC A02/MF A01 CSCL 01D

A probe was designed which can be mounted on a data boom and extended in parallel with the longitudinal axis of symmetry of an aircraft to provide local air speed and aircraft attitude intelligence. The probe employs both static pressure and total pressure transducers mounted in a tubular body supported for wind induced angular displacement about an axis normally related to the longitudinal axis of the aircraft. NASA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N78-25089* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GAS TURBINE ENGINE WITH RECIRCULATING BLEED Patent
Arthur P. Adamson, inventor (to NASA) (GE, Cincinnati, Ohio) Issued 11 Apr. 1978 5 p Filed 14 Jun. 1976 Sponsored by NASA
(NASA-Case-LEW-12452-1; US-Patent-4,083,181; US-Patent-Appl-SN-695513; US-Patent-Class-60-39.52; US-Patent-Class-60-226R) Avail: US Patent Office CSCL 21E

Carbon monoxide and unburned hydrocarbon emissions in a gas turbine engine are reduced by bleeding hot air from the engine cycle and introducing it back into the engine upstream of the bleed location and upstream of the combustor inlet. As this hot inlet air is recycled, the combustor inlet temperature rises rapidly at a constant engine thrust level. In most combustors, this will reduce carbon monoxide and unburned hydrocarbon emissions significantly. The preferred locations for hot air extraction are at the compressor discharge or from within the turbine, whereas the preferred reentry location is at the compressor inlet. Official Gazette of the U.S. Patent Office

N78-25090* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COUNTER PUMPING DEBRIS EXCLUDER AND SEPARATOR Patent
Lawrence P. Ludwig, inventor (to NASA) Issued 18 Apr. 1978 5 p Filed 31 Mar. 1976 Supersedes N76-20487 (14 - 11, p 1394)
(NASA-Case-LEW-11855-1; US-Patent-4,084,825; US-Patent-Appl-SN-672222; US-Patent-Class-277-25; US-Patent-Class-277-134) Avail: US Patent Office CSCL 21E

A dirt separator and excluder for removing entrained debris from gas turbine shaft seals is described. A helical groove pattern is constructed on the rotating shaft with the pumping pattern such that it tends to pump seal pressurizing gas toward the gas turbine seal. A second helical groove pattern is provided on the stationary housing or counter rotating member coaxial with the shaft, and this pattern is designed to provide pumping in the direction opposite from that of the groove pattern on the shaft. Gas with entrained debris entering this grooved area will be subjected to high centrifugal forces due to the swirl motion induced by the groove pattern and the rotation of the shaft. This debris is centrifuged outwardly into the outer groove pattern on the housing or counter rotating member. Because the outer groove pattern has a pumping direction opposite from that of the seal, dirt is pumped away from the seal and can be collected in a suitable debris trap remote from the seal location.
Official Gazette of the U.S. Patent Office

N78-25091 Ecole Polytechnique Federale de Lausanne (Switzerland). Inst. de Thermique Appliquee.
DEPOSITION OF FINE PARTICLES IN THE OPENING OF FILM-COOLED GAS TURBINE BLADES
Jean-Claude Mevillot Zurich Juris-Verlag 1975 197 p refs In FRENCH; ENGLISH summary
(EPFL-ITA-2; ISBN-3-260-04048-X) Avail: Juris-Verlag Sw. Fr. 16

The film cooled blades of high temperature gas turbines have tiny cooling air-openings on the blade surface which could eventually get blocked by deposition of fine particles contained in the hot gas, formed, e.g., in the combustion chamber. To study the risk of blockage two fundamental problems must be treated. The trajectories of the particles near the blades and in the cooling-air holes for which the impinging mass-rate is calculated for statistical distributions of the particle size, and the problem of adhesion in order to decide whether the particle adheres or is repelled after impact, are both studied. The governing parameters for both problems are defined together with the probable order of magnitude for application. All results are presented in a dimensionless manner in order to facilitate the transposition to any practical case. The theoretical results were verified on several experimental stands. As a result, only the cooling holes near the leading hedge of blades risk being blocked by particles. If the cooling air flows correctly, little is to be feared from dry solid particles (carbon). Weaker particles existing, e.g., during the starting of the combustion, can be more dangerous. In any case, particles less than 1.5 diameter will not reach the cooling hole walls. Author (ESA)

N78-25092*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
RESEARCH ON THE STATICALLY THRUSTING PROPELLER Final Report, Mar. 1970 - Jun. 1978
Joseph J. Eisenhuth Jun. 1978 41 p refs
(Grant NGL-39-009-172)
(NASA-CR-157214) Avail: NTIS HC A03/MF A01 CSCL 01A

Methods for calculating the induced flow at propeller blades were analyzed by treating the wake formation as an initial problem in time. An unsteady vortex lattice technique was applied to the wake formation and the vortex core size was studied. B.B.

N78-25093# National Aerospace Lab., Tokyo (Japan).
A HIGH-PRESSURE, SECTOR-SHAPED MODEL COMBUSTOR TEST FACILITY FOR DEVELOPMENT OF TURBOFAN ENGINES
Kunio Suzuki, Kenji Nishio, Shoji Horiuchi, Mamoru Koshinuma, Yujiro Kabe, and Kyuzo Ishihara Nov. 1977 32 p refs In JAPANESE; ENGLISH summary
(NAL-TR-517) Avail: NTIS HC A03/MF A01

A high-pressure, blow-down type turbine combustor test facility is reported that has a capacity of up to 30 atm of air from ambient temperature to 720 K. The test section can supply an airflow rate of either 10 kg/s in weight or 0.6 cu m/s in volume at the maximum. The combustor inlet temperature and pressure are independently regulated. Test duration is limited to between 60 and 100 seconds depending on the experimental condition. Control of the facility and experimental measurements are conducted by a minicomputer. Author

N78-25094# National Aerospace Lab., Tokyo (Japan).
ACOUSTICS AND PERFORMANCE OF HIGH-SPEED, UNEQUALLY SPACED FAN ROTORS

Shoichi Fujii, Hideo Nishiwaki, and Katsumi Takeda Feb. 1977 20 p refs In JAPANESE; ENGLISH summary
(NAL-TR-526) Avail: NTIS HC A02/MF A01

The effects of uneven blade spacing on the acoustic and aerothermodynamic characteristics of high-speed, high-pressure-ratio fan rotors were measured at two selected spacing configurations. A test rig, consisting of inlet guide vanes and transonic rotor blades, was employed to explore the redistribution of harmonics sound energy into a series of multiple tones of lower sound pressure level. The measured data indicated that a 10 percent modulated rotor exhibited a six to eight decibel decrease in sound pressure level as compared with the original first blade passage frequency harmonic. Disadvantages in aerodynamic performance resulting from spacing modulation were not unfavorable for 10 percent modulated blades. However, with 5 percent modulated blades, serious deterioration in aerodynamic performance was observed particularly near the blade tip section, which produced an unfavourable acoustic signature. A calculation method, assuming a pulse event for each blade sound pressure, provided agreeable results with the measured data. Author

N78-25095# National Mechanical Engineering Research Inst., Pretoria (South Africa). Aeronautics Research Unit.
PERFORMANCE TESTS AND DESIGN MODIFICATIONS OF A WANKEL TYPE ROTARY COMBUSTION AUTOMOBILE ENGINE IN ORDER TO DETERMINE ITS SUITABILITY FOR AIRCRAFT APPLICATION
E. R. Leeman, A. J. VanWyk, and I. S. Myburgh Jun. 1977 19 p refs
(CSIR-ME-1521) Avail: NTIS HC A02/MF A01

Performance tests and design modifications are reported for a standard production Mazda RX2 automobile engine of the Wankel type in order to make it suitable for aircraft applications. Author

N78-25096# Maxwell Labs., Inc., Woburn, Mass. Utility Products Div.
INDUCTOR NETWORK DEVELOPMENT FOR AIRCRAFT HIGH POWER SUPPLIES Final Report, Jan. 1974 - Feb. 1977
J. Tenko, R. L. Bryan, S. Ghoshroy, L. M. Lontai, and O. K. Sonju Apr. 1977 248 p
(Contract F33615-74-C-20; AF Proj. 3145)
(AD-A052750; AFAPL-TR-77-15) Avail: NTIS HC A11/MF A01 CSCL 10/2

This report presents the results of a study program undertaken to perform a comparative analysis of several approaches to the generation of high electrical power by storing tens to hundreds of kilojoules of energy in a compact, superconducting inductive system with efficient extraction in short bursts at high repetition rates. The critical factors for the comparison were the weight, volume, dissipation and reliability of the system and components for various operating regimes characterized by pulse power, repetition rate and pulse shape. Research and development work hitherto undertaken in the U.S. and abroad indicate the engineering feasibility of operating inductive storage systems storing ten to perhaps one hundred kilojoules of energy with extraction rates of tens of pulses per second at pulse durations of the order of a few hundred microseconds with state-of-the-art technology. The major effort of this study was directed towards developing analytical tools to predict the performance of superconducting coils at repetition rates of 100 - 1000 pps with pulse discharge times of 20 - 40 microseconds and to evaluate the relative merits of different circuit configurations for storage and extraction of energy at high average power (3 - 10 MW). At frequencies of a few hundred pulses per second, it appears that inductive storage has a distinct advantage over capacitive storage at power levels of the order 1 - 10 MW. GRA

N78-25097# McDonnell Aircraft Co., St. Louis, Mo.
VARIABLE CYCLE ENGINE EVALUATIONS FOR SUPERSONIC V/STOL FIGHTERS. PHASE 2 AND 3 TECHNICAL REPORT Final Report, Jun. 1975 - Mar. 1978
J. E. Cupstid and D. G. Glennie Apr. 1978 153 p refs
(Contract N00140-75-C-0034)
(AD-A053361) Avail: NTIS HC A08/MF A01 CSCL 21/5

Variable cycle engines (VCE) have been evaluated using advanced V/STOL fighter designs. The VCE payoffs were assessed in terms of total weapon system cost effectiveness and results indicate that they offer potential benefits in supersonic V/STOL fighters. A systematic engine/airframe evaluation procedure was developed and used to assess interactions for advanced engine concepts in L - L/C aircraft designs. The evaluation procedure provides a rapid and inexpensive technique for evaluating engine concepts considering a large matrix for engine and airframe design and sizing variables. The procedure was used to establish a parametric data base using both fixed cycle turbofans and variable geometry turbine turbojets. Specific engine/airframe designs were then selected for detailed comparisons. Engine/airframe design evaluations were also conducted using a variable cycle turbofan engine capable of being used with both L - L/C and L/C aircraft. These aircraft designs were compared to the fixed cycle turbofan and variable geometry turbine turbojet aircraft designs in terms of TOGW, performance, life cycle cost, and operational flexibility. Author (GRA)

N78-25098# McDonnell Aircraft Co., St. Louis, Mo.
VARIABLE CYCLE ENGINE EVALUATIONS FOR SUPERSONIC V/STOL FIGHTERS. MANAGEMENT SUMMARY REPORT Final Summary Report, Jun. 1975 - Mar. 1978
J. E. Cupstid and D. G. Glennie Apr. 1978 58 p refs
(Contract N00140-75-C-0034)
(AD-A053362) Avail: NTIS HC A04/MF A01 CSCL 21/5
For abstract, see N78-25097.

N78-25099# National Technical Information Service, Springfield, Va.
AIRCRAFT SONIC BOOM: EFFECTS ON BUILDINGS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1978
Guy E. Habercom, Jr. Mar. 1978 77 p Supersedes NTIS/PS-77/0219; NTIS/PS-77/0176 2 Vol.
(NTIS/PS-78/0239; NTIS/PS-77/0219; NTIS/PS-76/0176)
Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 20A

Research findings are cited on the effects of sonic booms on buildings, structural components, forms, windows, and walls. Test-house investigations are included, along with damage analysis and vibration response. Documentation is made on residential buildings. Other topics contained in the volume range from theory to failure analysis. Sonic boom propagation and effects on biological forms, including human responses, are cited in separate bibliographies. GRA

N78-25100# National Technical Information Service, Springfield, Va.
AIRCRAFT SONIC BOOM: STUDIES ON AIRCRAFT FLIGHT, AIRCRAFT DESIGN, AND MEASUREMENT. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1978
Guy E. Habercom, Jr. Mar. 1978 187 p Supersedes NTIS/PS-77/0218; NTIS/PS-76/0175 2 Vol.
(NTIS/PS-78/0238; NTIS/PS-77/0218; NTIS/PS-76/0175)
Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 20A

The reports discuss aerodynamic design of aircraft and wings, flight characteristics and maneuvers, supersonic transport characteristics, acoustic fields and noise measurement, government policies and regulations, meteorological parameters, shock waves, and supersonic and hypersonic wind tunnel tests, along with other theoretical and general investigations. Structural and biological effects are documented in separate published searchers. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N78-25101*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MODAL CONTROL THEORY AND APPLICATION TO AIRCRAFT LATERAL HANDLING QUALITIES DESIGN
S. Srinathkumar Jun. 1978 63 p refs

(NASA-TP-1234; L-12177) Avail: NTIS HC A04/MF A01 CSCL 01C

A multivariable synthesis procedure based on eigenvalue/eigenvector assignment is reviewed and is employed to develop a systematic design procedure to meet the lateral handling qualities design objectives of a fighter aircraft over a wide range of flight conditions. The closed loop modal characterization developed provides significant insight into the design process and plays a pivotal role in the synthesis of robust feedback systems. The simplicity of the synthesis algorithm yields an efficient computer aided interactive design tool for flight control system synthesis. Author

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N78-25102# National Mechanical Engineering Research Inst., Pretoria (South Africa). Aeronautics Research Unit.

THE USE OF A LASER DOPPLER ANEMOMETER IN A HIGH SPEED BLOWDOWN WIND TUNNEL

A. Nurick Jan. 1977 61 p refs Presented at the 47th Semiannual Meeting of the Supersonic Tunnel Assoc., Calif., 7-8 Apr. 1977

(CSIR-ME-1496) Avail: NTIS HC A04/MF A01

The basic theoretical and practical principles of the operation of a Laser Doppler Aneometer (LDA) and its application to a transonic blowdown wind tunnel are presented. Examples of work which have already been carried out in the flow regime are presented. Attention is drawn to the importance of adequate seeding of the air. A possible LDA system for a transonic wind tunnel is proposed. Author

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N78-25103*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

DESCRIPTIONS OF EXPERIMENTS SELECTED FOR THE SPACE TRANSPORTATION SYSTEM (STS) MATERIALS PROCESSING IN SPACE PROGRAM

Robert J. Naumann, ed. May 1978 33 p

(NASA-TM-78175) Avail: NTIS HC A03/MF A01 CSCL 22A

Summaries are presented for the first group of materials processing experiments planned for a shuttle mission. Outlined are the objectives, the approach, the rationale for the use of space, and the anticipated results for each experiment. Author

N78-25104# Committee on Science and Technology (U. S. House).

WORLD-WIDE SPACE ACTIVITIES. NATIONAL PROGRAMS OTHER THAN THE UNITED STATES AND SOVIET UNION; INTERNATIONAL PARTICIPATION IN THE US POST-APOLLO PROGRAM; INTERNATIONAL COOPERATION IN SPACE SCIENCE, APPLICATIONS AND EXPLORATION; ORGANIZATION; AND IDENTIFICATION OF MAJOR POLICY ISSUES

Washington GPO 1977 638 p refs Rept. for Subcomm. on the Space Sci. and Applications of the Comm. on Sci. and Technol., 95th Congr., 1st Sess., Sep. 1977 Prepared by Library of Congr., Sci. Policy Res. Div.

(H-Doc-95-352; GPO-29-377) Avail: SOD HC

The growing world-wide involvement in space and its utilization by a manner of foreign nations is discussed. Considered are all national programs other than the United States and Soviet Union for: international participation in the U.S. Post-Apollo program; international cooperation in space science, applications and exploration; organization; and identification of major policy issues. G.G.

N78-25105*# Business and Technological Systems, Inc., Seabrook, Md.

SEP ENCKE-87 AND HALLEY RENDEZVOUS STUDIES AND IMPROVED S/C MODEL IMPLEMENTATION IN HILTOP Final Report

J. L. Horsewood and F. I. Mann Feb. 1978 29 p refs

(Contract NAS3-20950)

(NASA-CR-135414; BTS-TR-78-55-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 22A

Studies were conducted to determine the performance requirements for projected state-of-the-art SEP spacecrafts boosted by the Shuttle/IUS to perform a rendezvous with the comet Halley and a rendezvous with the comet Encke during its 1977 apparition. The spacecraft model of the standard HILTOP computer program was assumed. Numerical and graphical results summarizing the studies are presented. Author

N78-25106*# Business and Technological Systems, Inc., Seabrook, Md.

HELIOCENTRIC INTERPLANETARY LOW THRUST TRAJECTORY OPTIMIZATION PROGRAM, SUPPLEMENT 1, PART 2 Final Report

F. I. Mann and J. L. Horsewood Feb. 1978 103 p refs

(Contract NAS3-20950)

(NASA-CR-135414-App; BTS-TR-78-54-Suppl-1-Pt-2) Avail: NTIS HC A06/MF A01 CSCL 22A

The improvements made to the HILTOP electric propulsion trajectory computer program are described. A more realistic propulsion system model was implemented in which various thrust subsystem efficiencies and specific impulse are modeled as variable functions of power available to the propulsion system. The number of operating thrusters are staged, and the beam voltage is selected from a set of five (or less) constant voltages, based upon the application of variational calculus. The constant beam voltages may be optimized individually or collectively. The propulsion system logic is activated by a single program input key in such a manner as to preserve the HILTOP logic. An analysis describing these features, a complete description of program input quantities, and sample cases of computer output illustrating the program capabilities are presented. Author

N78-25107*# Rockwell International Corp., Downey, Calif. Space Div.

SPACE INDUSTRIALIZATION. VOLUME 1: EXECUTIVE SUMMARY Final Report

Apr. 1978 43 p

(Contract NAS8-32198)

(NASA-CR-150720; SD-78-AP-0055-1) Avail: NTIS HC A03/MF A01 CSCL 22A

Potential goals for space industrialization were identified, and evolutionary program options for the realization of those goals were developed and assessed. Program support demands were defined, and recommendations were made in relation to program implementation. Author

N78-25108*# Rockwell International Corp., Downey, Calif. Space Div.

SPACE INDUSTRIALIZATION. VOLUME 2: SPACE INDUSTRIALIZATION BACKGROUND, NEEDS, AND OPPORTUNITIES Final Report

Apr. 1978 268 p refs

(Contract NAS8-32198)

(NASA-CR-150721; SD-78-AP-0055-2) Avail: NTIS HC A12/MF A01 CSCL 22A

For abstract, see N78-25107.

N78-25109*# Rockwell International Corp., Downey, Calif. Space Div.

SPACE INDUSTRIALIZATION. VOLUME 3: SPACE INDUSTRIALIZATION IMPLEMENTATION CONCEPTS Final Report

14 Apr. 1978 258 p

(Contract NAS8-32198)

(NASA-CR-150722; SD-78-AP-0055-3) Avail: NTIS

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N78-25123*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A DIGITAL COMPUTER PROGRAM FOR THE DYNAMIC INTERACTION SIMULATION OF CONTROLS AND STRUCTURE (DISCOS), VOLUME 1

Carl S. Bodley (Martin Marietta Corp., Denver), A. Darrell Devers (Martin Marietta Corp., Denver), A. Colton Park (Martin Marietta Corp, Denver), and Harold P. Frisch May 1978 169 p refs (NASA-TP-1219-Vol-1; G7702-F26-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 22B

A theoretical development and associated digital computer program system for the dynamic simulation and stability analysis of passive and actively controlled spacecraft are presented. The dynamic system (spacecraft) is modeled as an assembly of rigid and/or flexible bodies not necessarily in a topological tree configuration. The computer program system is used to investigate total system dynamic characteristics, including interaction effects between rigid and/or flexible bodies, control systems, and a wide range of environmental loadings. In addition, the program system is used for designing attitude control systems and for evaluating total dynamic system performance, including time domain response and frequency domain stability analyses.

Author

N78-25124*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A DIGITAL COMPUTER PROGRAM FOR THE DYNAMIC INTERACTION SIMULATION OF CONTROLS AND STRUCTURE (DISCOS), VOLUME 2

Carl S. Bodley (Martin Marietta Corp., Denver), A. Darrell Devers (Martin Marietta Corp., Denver), A. Colton Park (Martin Marietta Corp., Denver), and Harold P. Frisch May 1978 368 p (NASA-TP-1219-Vol-2; G7702-F26-Vol-2) Avail: NTIS HC A16/MF A01 CSCL 22B

For abstract, see N78-25123.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N78-25125+ Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Dept. RV-SA.

SMM-HXIS THERMAL DEFORMATION ANALYSIS

C. Blaas and J. OBrien 21 Jun. 1977 11 p refs (FOK-RV-77-48) Avail: NTIS HC A02

The distortion and misalignment of the solar maximum mission hard X-ray spectrometer were calculated for a number of thermal load cases. Detailed NASTRAN temperature impact was made for the elements of the collimator, the instrument support plate, and connecting bats. The output from the thermal model supplied unique temperatures for most of the elements. Results are presented for distortion of the collimator tube and instrument misalignment.

ESA

N78-25126*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

ALT SPACE SHUTTLE BAROMETRIC ALTIMETER ALTITUDE ANALYSIS

Rosemary Killen Jun. 1978 70 p refs (NASA-TM-79528; JSC-13937; Rept-78FM22) Avail: NTIS HC A04/MF A01 CSCL 14B

The accuracy was analyzed of the barometric altimeters onboard the space shuttle orbiter. Altitude estimates from the air data systems including the operational instrumentation and the developmental flight instrumentation were obtained for each of the approach and landing test flights. By comparing the barometric altitude estimates to altitudes derived from radar tracking data filtered through a Kalman filter and fully corrected for atmospheric refraction, the errors in the barometric altitudes were shown to be 4 to 5 percent of the Kalman altitudes. By comparing the altitude determined from the true atmosphere derived from weather balloon data to the altitude determined from the U.S. Standard Atmosphere of 1962, it was determined that the assumption of the Standard Atmosphere equations contributes roughly 75 percent of the total error in the baro estimates. After correcting the barometric altitude estimates using an average summer model atmosphere computed for the average latitude of the space shuttle landing sites, the residual error in the altitude estimates was reduced to less than 373 feet. This corresponds to an error of less than 1.5 percent for altitudes above 4000 feet for all flights.

Author

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N78-25127*# Rocketdyne, Canoga Park, Calif. Advanced and Propulsion Engineering Units.

ADVANCED SPACE ENGINE POWERHEAD BREADBOARD ASSEMBLY SYSTEM STUDY Final Report, Dec. 1976 - Jun. 1977

R. G. Campbell Mar. 1978 170 p refs (Contract NAS3-20386) (NASA-CR-135232; RI/RD77-192) Avail: NTIS HC A08/MF A01 CSCL 21H

The objective of this study was to establish a preliminary design of a Powerhead Breadboard Assembly (PBA) for an 88 964-Newton (20,000-pound) thrust oxygen/hydrogen staged combustion cycle engine for use in orbital transfer vehicle propulsion. Existing turbopump, preburner, and thrust chamber components were integrated with interconnecting ducting, a heat exchanger, and a control system to complete the PBA design. Cycle studies were conducted to define starting transients and steady-state balances for the completed design. Specifications were developed for all valve applications and the conditions required for the control system integration with the facility for system test were defined.

Author

N78-25128*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SOLID ROCKET BOOSTER THRUST VECTOR CONTROL SUBSYSTEM TEST REPORT (D-1)

Buris Pagan Apr. 1978 96 p (NASA-TM-78174) Avail: NTIS HC A05/MF A01 CSCL 21H

The results of the sequence of tests performed on the space shuttle solid rocket booster thrust vector control subsystem are presented. The operational characteristics of the thrust vector control subsystem components, as determined from the tests, are discussed. Special analyses of fuel consumption, basic steady state characteristics, GN2 spin, and actuator displacement were reviewed which will aid in understanding the performance of the auxiliary power unit. The possibility of components malfunction is also discussed.

Author

N78-25129# United Technologies Corp., Sunnyvale, Calif. Chemical Systems Div.

SHORT LENGTH SUPER HIPPO MOTOR ASSEMBLY Final Report, 4 Apr. - 3 Nov. 1977

P. R. Scannell and W. A. Stephen Feb. 1978 145 p refs (Contract F04611-77-C-0027) (AD-A053042; CSD-2635-FR; AFRPL-TR-77-91) Avail: NTIS

HC A07/MF A01 CSCL 21/8

The short length HIPPO motor is a single cartridge version of the Super HIPPO high pressure ballistic test motor. The motor operates at pressures up to 2,500 psi with propellant charge weights to 24,500 lb and is used to test rocket motor nozzles and components. This report summarizes the contract to design, fabricate, and install at AFRPL, including the first motor firing with a test nozzle for the Interim Upper Stage motor.

Author (GRA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N78-25130# California Univ., Berkeley. Lawrence Berkeley Lab.

STUDIES OF THE HYDROXYBOROHYDRIDE AND TRIBOROHYDRIDE IONS

J. Reed Oct. 1977 84 p refs Submitted for publication

(Contract W-7405-eng-48)

(LBL-6941) Avail: NTIS HC A05/MF A01

Results of the following studies are reported: chemical synthesis of hydroxytrihydroborate and peroxynitrite; the reduction of organic compounds with the hydroxyborohydride ion; and a kinetic study of the hydrolysis of the octahydrotriborate ions.

ERA

N78-25131# Argonne National Lab., Ill.

AB INITIO QUANTUM MECHANICAL CHARACTERIZATION OF THE GROUND ELECTRONIC STATE OF BENZO[a] PYRENE. IMPLICATIONS FOR THE MECHANISM OF PAH OXIDATION TO EXPOXIDES BY CYTOCHROME

L. M. Shipman 1977 16 p refs Presented at 2d Intern. Symp. on Polynucl. Aromatic Hydrocarbons, Columbus, Ohio, 29 Sep. 1977

(Contract W-31-109-eng-38)

(CONF-770963-4) Avail: NTIS HC A02/MF A01

Electronic properties have an important role in the metabolism of benzo [a] pyrene (BP) and the mutagenic action of its metabolites. In this paper, the ground electronic state of BP is characterized by the ab initio molecular fragment floating spherical Gaussian orbital method, and a speculative structural-electronic mechanism is presented for the oxidation of PAHs to epoxides by cytochrome P-450.

ERA

24 COMPOSITE MATERIALS

Includes laminates.

N78-25132*# TRW Equipment Labs., Cleveland, Ohio.

FIBER REINFORCED PMR POLYIMIDE COMPOSITES Final Report, 28 Jun. 1976 - 31 Oct. 1977

P. J. Cavano and W. E. Winters 15 May 1978 103 p refs

(Contract NAS3-20366)

(NASA-CR-135377; TRW-ER-7884F) Avail: NTIS HC A06/MF A01 CSCL 11D

Commercially obtained PMR-15 polyimide prepregs with S-glass and graphite fiber reinforcements were evaluated along with in-house prepared glass and graphite cloth PMR 2 materials. A novel autoclave approach was conceived and used to demonstrate that both the PMR systems respond to 1.4 MPa (200 psi) autoclave pressures to produce void free composites equivalent to die molded laminates. Isothermal gravimetric analysis and subsequent mechanical property tests indicated that the PMR 2 system was significantly superior in thermo-oxidative stability, and that S-glass reinforcements may contribute to the accelerated degradation of composites at 316 C (600 F) when compared to graphite fiber reinforced composites. Fully reversed bending fatigue experiments were conducted with a type of fixture unused for organic matrix composites. These studies indicated that the graphite fiber composites were clearly superior in fatigue resistance to the glass fiber reinforced material and that PMR matrix composite systems yield performance of the same order as composite materials employing other families of matrices.

Author

N78-25133*# IIT Research Inst., Chicago, Ill.

EVALUATION OF COMPOSITE FLATTENED TUBULAR SPECIMEN Final Report, 14 Oct. 1976 - 31 Dec. 1977

T. Liber and I. M. Daniel Jun. 1978 143 p refs

(Contract NAS1-14663)

(NASA-CR-145353; IITRI-D6131) Avail: NTIS HC A07/MF A01 CSCL 11D

Flattened tubular specimens of graphite/epoxy, S-glass/epoxy, Kevlar-49/epoxy, and graphite/S-glass/epoxy hybrid materials were evaluated under static and cyclic uniaxial tensile loading and compared directly with flat coupon data of the same materials generated under corresponding loading conditions. Additional development for the refinement of the flattened specimen configuration and fabrication was required. Statically tested graphite/epoxy, S-glass/epoxy, and Kevlar 49/epoxy flattened tube specimens exhibit somewhat higher average strengths than their corresponding flat coupons. Flattened tube specimens of the graphite/S-glass/epoxy hybrid and the graphite/epoxy flattened tube specimens failed in parasitic modes with consequential lower strength than the corresponding flat coupons. Fatigue tested flattened tube specimens failed in parasitic modes resulting in lower fatigue strengths than the corresponding flat coupons.

Author

N78-25134*# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering.

STRESS INTENSITY FACTORS OF COMPOSITE ORTHOTROPIC PLATES CONTAINING PERIODIC BUFFER STRIPS

Feridun Delale and Fazil Erdogan Jan. 1978 123 p refs

(Grant NGR-39-007-011)

(NASA-CR-145355) Avail: NTIS HC A06/MF A01 CSCL 11D

The fracture problem of laminated plates which consist of bonded orthotropic layers is studied. The fields equations for an elastic orthotropic body are transformed to give the displacement and stress expressions for each layer or strip. The unknown functions in these expressions are found by satisfying the remaining boundary and continuity conditions. A system of singular integral equations is obtained from the mixed boundary conditions. The singular behavior around the crack tip and at the bimaterial interface is studied. The stress intensity factors are computed for various material combinations and various crack geometries. The results are discussed and are compared with those for isotropic materials.

Author

N78-25135*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ENVIRONMENTAL EFFECTS ON COMPOSITES FOR AIRCRAFT

Richard A. Pride May 1978 24 p refs Presented at CTOL Transport Technol. Conf., Hampton, Va., 28 Feb. - 3 Mar. 1978. Published in NASA-CP-2036

(NASA-TM-78716; L-12288) Avail: NTIS HC A02/MF A01 CSCL 11D

A number of ongoing, long-term environmental effects programs for composite materials are evaluated. The flight service experience was evaluated for 142 composite aircraft components after more than 5 years and 1 million successful component flight hours. Ground-based outdoor exposures of composite material coupons after 3 years of exposure at 5 sites have reached equilibrium levels of moisture pickup which are predictable. Solar ultraviolet-induced material loss is discussed for these same exposures. No significant degradation was observed in residual strength for either stressed or unstressed specimens, or for exposures to aviation fuels and fluids.

Author

N78-25136*# National Aeronautics and Space Administration, Washington, D. C.

CARBON FIBER STUDY. A COMPILATION OF AN INTERGOVERNMENTAL COMMITTEE STUDY

May 1978 43 p

(NASA-TM-78718) Avail: NTIS HC A03/MF A01 CSCL 11D

Carbon fibers have opened a wealth of new structural

engineering and consumer product opportunities. The potential benefits are higher strength, and lighter weight military and commercial products, which portend energy savings and increases safety. Unfortunately, these benefits are not realized without risk. Inadvertent fiber release, during manufacture or by destruction of the resin binder in fire, is the major hazard associated with composites. The carbon (or graphite) fibers are finer than human hair and if released into the air, they can be easily transported by winds or currents. In contact with electrical devices, they can create resistive loading, short circuits, and arcing, resulting in stoppages or destruction. Their health impact is not fully known and requires careful research and analysis before any firm conclusions can be reached; however, based upon current available information, they are primarily an irritant to the eyes and skin, like fiberglass, rather than carcinogenic or destructive to lung tissue. Major manufacturers are aware of the unique problems associated with these materials and have successfully applied controls to avoid the inplant problems. Author

N78-25137*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

CHARGE INJECTION METHOD AND APPARATUS OF PRODUCING LARGE AREA ELECTRETS Patent Application

Edward L. Shriver, Orville Weaver, and Parampukattil K. C. Pilla, inventors (to NASA) (NAS-NRC) Filed 28 Apr. 1978 16 p (NASA-Case-MFS-23186-2; US-Patent-Appl-SN-900832) Avail: NTIS HC A02/MF A01 CSCL 11D

A large area homo-charged type electrojet is produced by continuously passing a roll or sheet of dielectric material through an oven or over a heated metal roller or metal plate of the same width as the dielectric material. Emerging from the heater, the material is then passed over a heated, electrically conductive, electrically grounded surface. While the material passes over this plate, a corona discharge is induced a slight distance above the dielectric by applying a high voltage direct current potential to a wire brush, a grid of narrow wires, or any other device capable of sustaining an electric corona discharge. A corona discharge is produced, and due to the slight electrical conductivity of the heated material, some of the electrical plasma produced from the discharge is injected into the heated dielectric a small distance beneath its surface. The moving dielectric passes over or through a region where it is cooled by a stream of air or water, bypassing over a cooled metal roller, or by some other means where no electrically conductive path is provided between opposing sides of the dielectric. NASA

N78-25138*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

CERAMIC FIBER INSULATING MATERIAL AND METHOD OF PRODUCING SAME Patent Application

Ruey Y. Lin (Carborundum Co., Niagara Falls, N. Y.) and Edward A. Struzik, inventors (to NASA) (Carborundum Co., Niagara Falls, N. Y.) Filed 11 Jun. 1978 29 p

(Contract NAS9-13641)

(NASA-Case-MSC-14795-2; US-Patent-Appl-SN-911747) Avail: NTIS HC A03/MF A01 CSCL 11D

A lightweight thermal/acoustical insulation foam based on Fiberfrax, alumina silica ceramic fibers was developed for general insulation applications. The foam which is lightweight, has good integrity resiliency, and can be easily shaped into various forms during fabrication, is produced by admixing insulating fibers such as alumina-silica fibers, phenol-formaldehyde fibers, glass fibers, or their mixtures with a surface active agent and soluble organic resinous binder, agitating the mixture to produce a stable homogenous foam, dewatering the foam and heat treating the dewatered form to produce a dry porous, non-fluid foam. One of the significant features of this development is the ability to control the density of the product over a wide range, from 0.5 to 1.5 pounds per cubic foot. The process used for generating the foam is applicable to other fibrous materials as well as and can be used with very fine or relatively coarse fibers. NASA

N78-25139# Oak Ridge Y-12 Plant, Tenn.

NEW YTTRIA PLASTERS

C. E. Holcombe, C. C. Edwards, and D. A. Carpenter Jan. 1978 29 p refs

(Contract W-7405-eng-26)

(Y-2104) Avail: NTIS HC A03/MF A01

A sinterable yttria (Y203) plaster was developed. The properties of the plaster depend on: (1) starting power characteristics; (2) type and concentration of the acid used for the liquid phase; and (3) the liquid-to powder (L/P) ratios. Physical and chemical properties of the yttria plaster were investigated. Plasters formed in the yttria acid water (dilute-acids) system were determined to consist mostly of needle (or plate) shaped hydroxysalt binder phases analogous to precipitates. The binder phases were shown to be of the form Y2(OH)/sub 6-m/X/sub m/x nH2O where m and n generally equal one. The decomposition behavior on heating yttria plasters was studied by thermal analyses. The nitric acid produced plasters decomposed to yttria below 600 C in argon; the hydrochloric acid produced plasters decomposed to yttria by 1520 C in argon or by 1100 C in air. Examination of scandium oxide and the rare earth oxides showed that several exhibited a plaster forming behavior similar to yttria. ERA

N78-25140# National Technical Information Service, Springfield, Va.

PLYWOOD RESEARCH AND APPLICATIONS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Feb. 1978

Robena J. Brown Mar. 1978 143 p Supersedes NTIS/PS-77/0252; NTIS/PS-76/0227 2 Vol.

(NTIS/PS-78/0236; NTIS/PS-77/0252; NTIS/PS-76/0227) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 11D

The bibliography of Government-sponsored research covers aspects of plywood; namely, panels, wood preservatives, laminates, drying, cutting structural properties, bonding, fire resistant coatings, marketing, and international trade. A few reports are cited on the associated pollution from the plywood industry. Wood finishes, maintenance, standards, surveys, and utilization for forest economics are included. GRA

N78-25141# National Technical Information Service, Springfield, Va.

PLYWOOD RESEARCH AND APPLICATIONS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Feb. 1978

Robena J. Brown Mar. 1978 291 p Supersedes NTIS/PS-77/0253 2 Vol.

(NTIS/PS-78/0237; NTIS/PS-77/0253) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 11D

For abstract, see N78-25140.

N78-25142# National Technical Information Service, Springfield, Va.

PARTICLE BOARDS: FABRICATION, USE, AND PROPERTIES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jan. 1978

Robena J. Brown Mar. 1978 216 p Supersedes NTIS/PS-77/0278; NTIS/PS-76/0158

(NTIS/PS-78/0285; NTIS/PS-77/0278; NTIS/PS-76/0158) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 11D

Worldwide engineering research reports on the fabrication, measurement, cutting, testing, and utilization of particle boards are cited in this bibliography compiled from a search of documents entered in the Engineering Index data base from 1970 through January 1978. Of the 209 citations, 18 are new entries to the previous edition. Author

N78-25143# National Technical Information Service, Springfield, Va.

PARTICLE BOARDS AND FIBERBOARDS: FABRICATION, USE, AND PROPERTIES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jan. 1978

Robena J. Brown Mar. 1978 154 p Supersedes NTIS/PS-77/0277; NTIS/PS-76/0157 and NTIS/PS-75/221

(NTIS/PS-78/0284; NTIS/PS-77/0277; NTIS/PS-76/0157; NTIS/PS-75/221) Avail: NTIS HC $28.00/MF $28.00 CSCL 11D

One hundred forty-seven federally-funded research reports are cited in this bibliography compiled from entries in the NTIS data base from 1964 through January 1978. Topics covered include particle and fiberboard manufacturing methods and economics, wood waste utilization, and structural members. Tests for mechanical and physical properties to insure improved

performance in construction technology are included. Boards made from wood particles, pulp, paper, and vegetable fibers are described as well as fiberboard products such as boxboard, pressboard, paperboard, and wallboard. Thirteen citations are new entries to the previous edition. Author

N78-25144# National Technical Information Service, Springfield, Va.
FIBERBOARDS: FABRICATION, USE, AND PROPERTIES, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1975 - Jan. 1978
Robena J. Brown Mar. 1978 275 p Supersedes NTIS/PS-77/0279; NTIS/PS-76/0160
(NTIS/PS-78/0286; NTIS/PS-77/0279; NTIS/PS-76/0160) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 11D

A search of documents entered into the Engineering Index data base from 1975 through January 1978 was used to compile this bibliography which covers worldwide engineering research on the fabrication, utilization, and properties of fiberboards. Methods of measurement and testing for quality and improved economic return are included relative to paper boards, boxboards, pressboards, linerboards, and wallboards. This updated bibliography contains 268 abstracts, 51 of which are new entries to the previous edition. Author

N78-25145# National Technical Information Service, Springfield, Va.
POLYTETRAFLUOROETHYLENE (TEFLON), VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Mar. 1978
Diane M. Cavagnaro Mar. 1978 134 p Supersedes NTIS/PS-77/0209; NTIS/PS-76/0217; NTIS/PS-75/353
(NTIS/PS-78/0268; NTIS/PS-77/0209; NTIS/PS-76/0217; NTIS/PS-75/353) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 11D

The bibliography covers tetrafluoroethylene in multiple applications, including its reactions, properties, performance evaluations, and the manufacturing. Author

N78-25146# National Technical Information Service, Springfield, Va.
POLYTETRAFLUOROETHYLENE (TEFLON), VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1975 - Mar. 1978
Diane M. Cavagnaro Mar. 1978 141 p Supersedes NTIS/PS-77/0211
(NTIS/PS-78/0269; NTIS/PS-77/0211) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 11D

For abstract, see N78-25145.

N78-25147# National Technical Information Service, Springfield, Va.
POLYTETRAFLUOROETHYLENE (TEFLON), VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - 1975
Diane M. Cavagnaro Mar. 1978 182 p
(NTIS/PS-78/0267) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 11D

For abstract, see N78-25145.

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N78-25148* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPARATUS FOR EXTRACTION AND SEPARATION OF A PREFERENTIALLY PHOTO-DISSOCIATED MOLECULAR ISOTOPE INTO POSITIVE AND NEGATIVE IONS BY MEANS OF AN ELECTRIC FIELD Patent
Horst E. Wilhelm, inventor (to NASA) (Colo. State Univ., Ft. Collins) Issued 18 Apr. 1978 5 p Sponsored by NASA
(NASA-Case-LEW-12465-1; US-Patent-4,085,332; US-Patent-Appl-SN-692413; US-Patent-Class-250-528; US-Patent-Class-55-2; US-Patent-Class-55-100; US-Patent-Class-55-101; US-Patent-Class-250-531; US-Patent-Class-250-423P) Avail: US Patent Office CSCL 07D

Molecules of one and the same isotope were preferentially photodissociated by a laser and an ultraviolet source, or by multiphoton absorption of laser radiation. The resultant ions were confined with a magnetic field, moved in opposite directions by an electric field, extracted from the photodissociation region by means of screening and accelerating grids, and collected in ducts. Official Gazette of the U.S. Patent Office

N78-25149*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORMULATED PLASTIC SEPARATORS FOR SOLUBLE ELECTRODE CELLS Patent Application
Dean W. Sheibley, inventor (to NASA) Filed 3 Nov. 1977 22 p
(NASA-Case-LEW-12358-2; US-Patent-Appl-SN-848428) Avail: NTIS HC A02/MF A01 CSCL 07D

Membranes comprising a hydrochloric acid-insoluble sheet of a mixture of a rubber and a powered ion transport material were designed for use in oxidation-reduction (REDOX) electrical accumulator cells. The sheet of thermoplastic rubber and an ion transport material, which may be in the form of a film on a flexible substrate such as asbestos or paper was made by dissolving the rubber in a solvent and mixing with the ion transport material which is 20-50 volume percent as compared with 80-50 volume percent rubber. Preferred ion transport materials include a salt or a chloride anion; a phosphonium, tertiary ammonium or quaternary ammonium cation; a metal oxide; and a silicate or boric acid. NASA

N78-25150*# Notre Dame Univ., Ind. Dept. of Aerospace and Mechanical Engineering.
BURNING OF LIQUID POOLS IN REDUCED GRAVITY Final Report, Mar. 1976 - Feb. 1977
A. Murty Kanury Jun. 1977 141 p refs
(Contract NAS3-20087)
(NASA-CR-135234; TR-77-33) Avail: NTIS HC A07/MF A01 CSCL 21B

The existing literature on the combustion of liquid fuel pools is reviewed to identify the physical and chemical aspects which require an improved understanding. Among the pre-, trans- and post-ignition processes, a delineation was made of those which seem to uniquely benefit from studies in the essential environment offered by spacelab. The role played by the gravitational constant in analytical and experimental justifications was developed. The analytical justifications were based on hypotheses, models and dimensional analyses whereas the experimental justifications were based on an examination of the range of gravity and gravity-dependent variables possible in the earth-based laboratories. Some preliminary expositions into the questions of feasibility of the proposed spacelab experiment are also reported. Author

N78-25151# Coast Guard Research and Development Center, Groton, Conn.
FIRE EXPOSURE TESTS OF POLYETHYLENE AND FIFTY-FIVE GALLON STEEL DRUMS LOADED WITH FLAMMABLE LIQUIDS, PHASE 2 Final Report
R. C. Richards and G. J. Munkenbeck, Jr. Aug. 1977 103 p
(AD-A052436; CGR/DC-20/77; USCG-D-86-77) Avail: NTIS HC A06/MF A01 CSCL 13/4

Tests were conducted to compare the resistance of steel and polyethylene drums to fire exposure. Fire exposures were varied from 90 square foot fires completely engulfing the drum to 25 square foot fires exposed to one side of the drum. Lubricating oil, JP-4 (aviation fuel), and ethyl ether were used in the drums to examine the effects of cargo volatility. The internal pressure, internal temperature, external temperature, temperature at the bung, time to failure, and mode of failure were recorded for each drum tested. The results agree with previous tests. Polyethylene drums fail by melting and collapsing into the fire. Steel drums fail by jetting and/or exploding. The size of the

fire had no significant effect on the time to failure for polyethylene drums and an effect could not be determined for steel drums due to inconsistencies in manufacturing. Both types of drums fail within the same length of time when loaded with cargos more volatile than JP-4. The polyethylene drums fail 3 to 4 minutes sooner than steel drums loaded with fuels in the volatility range of JP-4 or lower. Author (GRA)

N78-25152# Indiana Univ., Bloomington. Dept. of Chemistry.
BIENNIAL REVIEW ON FLAME EMISSION, ATOMIC FLUORESCENCE SPECTROMETRY FOR ANALYTICAL CHEMISTRY
Gary M. Hieftje and Thomas R. Copeland Feb. 1978 48 p refs
(Contract N00014-76-C-0838)
(AD-A052756; TR-12) Avail: NTIS HC A03/MF A01 CSCL 17/4

A review of developments in flame emission, atomic absorption, and atomic fluorescence spectrometry is presented, and covers advances in instrumentation, theory, and methodology which have occurred over the period of Nov. 1, 1975-Nov. 1, 1977. Both English and foreign journals have been used in compiling an extensive bibliography. Coverage of published articles is critical rather than encyclopedic, and trends in the reviewed fields are noted. Author (GRA)

N78-25153# AeroChem Research Labs., Inc., Princeton, N. J.
BREADBOARD CHEMILUMINESCENT ANALYZER FOR MEASUREMENT OF HYDRAZINES Final Report, 20 Aug. 1976 - 20 Apr. 1977
Hermann N. Volltrauer and Leonard J. Luskus Dec. 1977 22 p refs
(Contract F33615-76-C-0602; AF Proj. 7930)
(AD-A053000; AeroChem-TP-355; SAM-TR-77-36) Avail: NTIS HC A02/MF A01 CSCL 21/9

An instrument was built that will measure concentrations of hydrazine, MMH, and UDMH in the range of 0.07 to 100 ppm and NO2 in the range of 1 to 100 ppm. The performance of the instrument is described and test results are given. Author (GRA)

N78-25154# Ames Lab., Iowa.
EVALUATION OF SORBENTS AS ORGANIC COMPOUND ACCUMULATORS
Colin D. Chriswell, James S. Fritz, and Harry J. Svec 1977 10 p refs Presented at 5th Conf. on Water Quality Technol., Kansas City, Mo., 4 Dec. 1977 Sponsored in part by EPA
(Contract W-7405-eng-82)
(IS-M-123; Conf-771223-1) Avail: NTIS HC A02/MF A01

Sorptive properties of sixteen different activated carbons and synthetic resins were evaluated by comparing the recoveries of organic materials from municipal and energy-related water sources. ERA

N78-25155# California Univ., Livermore. Lawrence Livermore Lab.
BEHAVIOR OF THE CALCIUM ELECTRODE IN AQUEOUS ELECTROLYTE
J. F. Cooper and P. K. Hosmer Oct. 1977 21 p refs Presented at Electrochemical Soc. Meeting, Atlanta, 9 Oct. 1977
(Contract W-7405-eng-48)
(UCRL-79457; Conf-771060-3) Avail: NTIS HC A02/MF A01

The behavior of the calcium electrode in aqueous electrolytes was investigated by using potentiostatic and galvanostatic techniques. Polarization curves and coulombic efficiency data for calcium dissolution were obtained for mixed sodium hydroxide-sodium chloride electrolytes under conditions of forced electrolyte convection. While the electrode tended to passivate in pure hydroxide solutions, the addition of the chloride ion produced a stable active state, which obeyed a linear polarization law. ERA

N78-25156# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
PROCEDURES FOR ANALYSIS OF SOLIDS AND LIQUORS FROM CELLULOSIC SOURCES
Raymond Freitas, Bill Long, Aldo Sciamanna, and Charles R. Wilke Dec. 1977 15 p refs
(Contract W-7405-eng-48)
(LBL-5967) Avail: NTIS HC A02/MF A01

Cellulosic materials are ground or milled to a suitable size. Ash analysis was made by determination of the residue after ignition at 600 C. Extractives were defined as the material removed by extraction with benzene/ethanol azeotrope. The lignin was determined as the acid-insoluble residue after 2 stage hydrolysis with H2SO4. The carbohydrate content was determined as the monomer sugars generated by the hydrolysis. The liquors from the acid or base treatment or cellulosic materials were analyzed for the monomer and polymer sugar content. ERA

N78-25157# General Motors Research Labs., Warren, Mich.
THEORETICAL CALCULATIONS OF THE ATOMIC HYDROGEN PLUS MOLECULAR OXYGEN INTERACTION FOR THE COMBUSTION REACTIONS
Richard J. Blint and Carl B. Melius 29 Aug. 1977 16 p refs Presented at the Western State Sect.-Combust. Inst. Meeting, Palo Alto, Calif., 17 Oct. 1977 Prepared in cooperation with Sandia Labs., Livermore, Calif.
(Contract EY-76-C-04-0789)
(GMR-2473; Conf-771015) Avail: NTIS HC A02/MF A01

A potential energy surface for the H(2S) + O2(3 Sigma-/sub g/) yields HO2(A2') isobar yields OH(/sup 2/PI) + O(P3) reaction is calculated to investigate the potential energy dependent effects of the reaction. Two-dimensional cuts in the full three-dimensional surface were calculated holding either the O-O distance of the H-O-O angle fixed and varying the O-H distance and the other coordinate. Extrema for both the saddle points (barriers) and minima were determined for each of these cuts. These calculations predict a heretofore unexpected reaction barrier which may be the explanation of the experimental variations in the HO2 collisional stabilization reaction. Interpretation of the calculations indicates which molecular energy modes dominate the reaction kinetics. ERA

N78-25158# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
SODIUM TECHNOLOGY PROGRAM: FRICTION, WEAR AND SELF-WELDING Quarterly Progress Report for Period Ending 31 Jul. 1977
William E. Ray Dec. 1977 57 p
(Contract EY-76-C-02-3045-001)
(WARD-NA-3045-49) Avail: NTIS HC A04/MF A01

The objectives of the friction and wear test program are: To ensure that no component in the FFTF or CRBRP will fail to perform its function by evaluating the friction and wear behavior of reference and alternate material combinations in interface configurations simulating reactor components under prototypic service conditions and environments, and to provide reactor designers with the quantitative data and experience factors necessary to successfully design components or component interfaces which will experience sliding or static contact under load. ERA

N78-25159# Columbia Univ., New York. School of Engineering and Applied Science.
THERMAL CONDUCTIVITY OF MERCURY VAPOR Ph.D. Thesis
J. R. Siegel 1977 112 p refs
(Contract EY-76-S-02-3072)
(COO-3027-31) Avail: NTIS HC A06/MF A01

The method employing the frequency response of a thin hot wire was used to determine the thermal conductivity of mercury vapor in a temperature range from 254 C to 992 C with an average superheat range up to 75 C. A thin tungsten wire was surrounded by mercury vapor in a cell and heated with an alternating current. The thermal conductivity of the mercury vapor was determined relative to that of argon by comparing the frequency response of the same wire to both mercury vapor and argon. In addition, the phenomenon of mercury dimerization is discussed. Several references on the diatomic nature of mercury vapor at various operating conditions were correlated and the effects of the disassociation of mercury vapor on its thermal conductivity estimated. An empirical correlation for percent dimer as a function of temperature and pressure is presented. ERA

N78-25160# Tennessee Univ., Knoxville. Dept. of Chemistry.
PHYSICAL-CHEMICAL STUDIES OF TRANSURANIUM ELEMENTS Progress Report, 1 Apr. 1977 - 31 Mar. 1978
J. R. Peterson 1978 35 p refs
(Contract EY-76-S-05-4447)
(ORO-4447-064) Avail: NTIS HC A02/MF A01

CfCl2, EsCl2, EsBr2, and EsI2 were synthesized and characterized spectrophotometrically, as were several mixed-valence lanthanide-actinide halides (e.g., GdCf4Cl11) and CmF4, CfF4, and EsF3. All samples not containing einsteinium were also examined by X-rays. Studies of the chemical consequences of the radioactive decay series Es-253 alpha decaying to Bk-249 beta decaying to Cf-249 have continued and expanded. Elemental Cm-248 was prepared on the one-half milligram scale and used to synthesize CmP and CmSb. Single crystals of AmTe2 and AmSe2 were grown from a Te melt and by iodine transport, respectively. The SQUID magnetometer was tested successfully in a preliminary configuration, and the expected sensitivity of the device was confirmed. A new design for the flux sensing coils was incorporated prior to an apparatus calibration experiment with lead. ERA

N78-25161# National Technical Information Service, Springfield, Va.
ELECTRODIALYSIS DESALINATION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1978
Diane M. Cavagnaro Mar. 1978 98 p Supersedes NTIS/PS-77/0017; NTIS/PS-76/0012
(NTIS/PS-78/0244; NTIS/PS-77/0017; NTIS/PS-76/0012) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 07D

Citations concerning electrodialysis desalination from journals covering worldwide engineering research are presented. This includes studies on theory, membrane preparation, performance test, and pilot plant operations. Both drinking water and waste water treatment processes are discussed. Author

N78-25162# National Technical Information Service, Springfield, Va.
ELECTRODIALYSIS DESALINATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1978
Diane M. Cavagnaro Mar. 1978 150 p Supersedes NTIS/PS-77/0018; NTIS/PS-76/0011; NTIS/PS-75/135
(NTIS/PS-78/0243; NTIS/PS-77/0018; NTIS/PS-76/0011; NTIS/PS-75/135) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 07D

A bibliography containing 145 abstracts on Federally funded research presents annotated references on electrodialysis desalination, theory, membrane preparation and performance, and test and pilot plant operations. Reports are cited which cover water treatment operations as well as waste treatment processes. Author

N78-25163# Honeywell, Inc., Bloomington, Minn.
STUDY OF A THERMAL AEROSOL OIL BURNER Final Report, Sep. 1976 - May 1977
J. E. Janssen, J. J. Glatzel, E. R. Wabasha, and U. Bonne Sep. 1977 47 p refs
(Contract EPA-68-02-2194)
(PB-277438; EPA-600/7-77-108) Avail: NTIS HC A03/MF A01 CSCL 21B

A thermal aerosol oil burner is studied for poor atomization and excess burner capacity that are known to reduce seasonal efficiency and contribute to excess emissions in residential oil burners. Generation of a thermal aerosol of the fuel was shown to improve combustion in terms of: (1) increased quantity and volume of fuel droplets 1 micrometer and smaller; (2) permitted firing rate reduction in standard nozzles of 50 to 70%; (3) when combined with swirl, gave increased combustion efficiency by permitting operation at 2% flue oxygen with nonluminous flame, zero Bacharach smoke no., no hydrocarbons, and no detectable CO; (4) reduced NOx formation in most cases; (5) reduced emissions during burner start-up; and (6) permitted modulation of firing rate without affecting combustion adversely. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N78-25164+ Fiat Aviazione S.p.A., Turin (Italy). Lab. Metallurgico.
WELDABILITY OF GAS TURBINE ALLOYS - RESEARCH PROJECT 18 European Concerted Action. Cost 50 - Materials for Gas Turbines. Final Report
M. Bussi, W. Dumini, and S. Fagone 27 Jun. 1977 82 p Prepared jointly with Ist. Ric. Breda
Avail: NTIS HC A05

The following weldability tests were carried out (EBW = electron beam welding, IW = inertia welding): IN 597/IN 597 (EBW); Ti-6Al-4V/-Ti-6Al-4V (EBW); Inco 718/Inco 718 (EBW); IN 586/IN 586 (EBW); Jethete-M152/Waspaloy (IW); and Jethete M152/Inco 718 (IW). The welding parameters and heat treatment were optimized, and metallurgical and mechanical tests to evaluate the welded joint characteristics were performed. Conclusions on the weldability of the alloys are presented. ESA

N78-25165+ Centre Oceanologique de Bretagne, Brest (France). Dept. Technologie et Developpement Industriel.
MARINE CORROSION. A BIBLIOGRAPHY [CORROSION MARINE BIBLIOGRAPHIE]
Lionel Lemoine and Jacques Thebault Paris Centre Natl. pour l'Exploitation des Oceans 1977 209 p refs Partly in FRENCH and partly in ENGLISH
(CNEXO-STR-36) Avail: NTIS HC A10

The bibliography is presented as a printed version of an online database available at CNEXO in interactive mode. The citations are given in first author alphabetical order. For this compilation of about 1000 citations an accession number is created sequential in the author sort. This number appears in the second part of the bibliography, devoted to permuted keyword index. ESA

N78-25166*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
MANUFACTURE OF ASTROLOY TURBINE DISK SHAPES BY HOT ISOSTATIC PRESSING, VOLUME 1 Final Report
R. D. Eng and D. J. Evans Mar. 1978 89 p refs
(Contract NAS3-20072)
(NASA-CR-135409; PWA-5574-12-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 11F

The Materials in Advanced Turbine Engines project was conducted to demonstrate container technology and establish manufacturing procedures for fabricating direct Hot Isostatic Pressing (HIP) of low carbon Astroloy to ultrasonic disk shapes. The HIP processing procedures including powder manufacture and handling, container design and fabrication, and HIP consolidation techniques were established by manufacturing five HIP disks. Based upon dimensional analysis of the first three disks, container technology was refined by modifying container tooling which resulted in closer conformity of the HIP surfaces to the sonic shape. The microstructure, chemistry and mechanical properties of two HIP low carbon Astroloy disks were characterized. One disk was subjected to a ground base experimental engine test, and the results of HIP low carbon Astroloy were analyzed and compared to conventionally forged Waspaloy. The mechanical properties of direct HIP low carbon Astroloy exceeded all property goals and the objectives of reduction in material input weight and reduction in cost were achieved. Author

N78-25167*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
MECHANICAL PROPERTIES AND THE ELECTRONIC STRUCTURE OF TRANSITION OF METAL ALLOYS Final Report
R. J. Arsenault and H. D. Drew [1977] 56 p refs
(Grant NsG-3001)
(NASA-CR-157216) Avail: NTIS HC A04/MF A01 CSCL 11F

This interdiscipline research program was undertaken in an effort to investigate the relationship between the mechanical strength of Mo based alloys with their electronic structure.

Electronic properties of these alloys were examined through optical studies, and the classical solid solution strengthening mechanisms were considered, based on size and molecular differences to determine if these mechanisms could explain the hardness data. Author

N78-25168# Lehigh Univ., Bethlehem, Pa.
FRACTURE BEHAVIOR OF A36 BRIDGE STEELS Final Report, Jul. 1975 - Apr. 1977
R. Roberts and G. V. Krishna Apr. 1977 64 p refs
(Contract DOT-FH-11-8819)
(PB-277908; FHWA-RD-77-156) Avail: NTIS HC A04/MF A01 CSCL 11F

The fracture toughness behavior of three heats of A36 steel was examined in terms of CVN response and K sub Ic measurements at an intermediate rate of loading (i.e., one second rise time to failure). These results were contrasted with current AASHTO toughness requirements and heat or H testing frequency. It was concluded that H frequency testing could prove to be inadequate for fracture critical details. In such instances each piece of steel should be tested for its CVN performance at the specification temperature. GRA

N78-25169# Naval Research Lab., Washington, D. C.
SIGNIFICANCE OF DELTA FERRITE CONTENT TO FATIGUE CRACK GROWTH RESISTANCE OF AUSTENITIC STAINLESS STEEL WELD DEPOSITS Final Report
J. R. Hawthorne 1 Mar. 1978 19 p refs
(AD-A053355; NRL-8201) Avail: NTIS HC A02/MF A01 CSCL 11/6

This report describes initial exploratory tests of fatigue crack growth resistance changes with one metallurgical variable, delta ferrite content, over a broad range of service temperatures. An initial study of the delta ferrite contribution to postirradiation fatigue behavior is also described. Reports documenting results of a companion study on preirradiation notch ductility characteristics versus delta ferrite content have been issued. GRA

N78-25170# National Materials Advisory Board, Washington, D. C.
ACCELERATED CORROSION OF COPPER-NICKEL PIPING Final Report
Dec. 1977 38 p refs
(Contract N00014-77-C-0251)
(AD-A053083; NMAB-343) Avail: NTIS HC A03/MF A01 CSCL 13/11

Unexpectedly severe corrosion occurred in cupro-nickel piping in seawater cooling systems aboard ships built in one location. A workshop, convened to discuss the problem, identified turbulence as a major contributing factor, and the practice of running the seawater loop wide open while throttling the fresh-water loop as contributory to the turbulence. Recommendations of the committee were: (1) reduce the velocity of flow in the pipes; (2) use long radius elbows whenever possible; and (3) conduct research of development to evaluate the following remedial measures--(1) suitability of alternate materials; (2) determination of the significance of the iron content in alloy 706 90 Cu-10 Ni; (3) investigation of the relative corrosion rate when a negative potential is applied to the system, using the cupronickel piping as a cathode; (4) control of seawater PH to a value of about 9.0; and (5) use of electrochemical probes to detect changes in corrosion rates. The committee, in commenting on the Navy's research program, felt that the turbulence aspect had been given inadequate attention, that the role of ammonia had not been given adequate consideration, that the design of the shore-based simulation test did not sufficiently resemble the installed conditions, and that more should be done on characterizing reaction product films. GRA

N78-25171# Wright State Univ., Dayton, Ohio. Dept. of Physics.
DETERMINATION OF CONSTITUTIVE EQUATIONS FOR TITANIUM ALLOYS APPLICABLE TO SHEET METAL FORMABILITY Final Report, 1 Feb. - 31 Dec. 1977
Joseph F. Thomas, Jr. Feb. 1978 24 p refs
(Grant AF-AFOSR-3252-77; AF Proj. 2306)
(AD-A053094; WSU-550F; AFOSR-78-0537TR) Avail: NTIS HC A02/MF A01 CSCL 11/6

A program to determine constitutive equations applicable to the sheet formability of the titanium alloy Ti-6Al-4V has been initiated. Load relaxation tests have been conducted at temperatures from 25 to 500 C over a strain-rate range of .1 to ten to the minus 8th power 1/sec using a programmable digital data acquisition system. The relaxation data, presented as log stress vs. log strain-rate hardness curves, illustrate the dependence of the strain-rate sensitivity, an important sheet metal formability index, on strain rate and temperature. The shapes of the hardness curves agree qualitatively with those predicted by the mechanical equation of state suggested by Hart. In particular, the transition from low temperature to high temperature grain matrix deformation behavior is clearly observed. Anomalous curvatures, apparently due to a strain aging mechanism, were observed in some room temperature hardness curves at low strain rates. Author (GRA)

N78-25172# Battelle Columbus Labs., Ohio.
INVESTIGATION OF REJUVENATION OF FATIGUE DAMAGE IN Ti6Al-4V Interim Report, 1 Jan. 1976 - 15 Mar. 1977
A. H. Clauer, B. N. Leis, R. B. Love, D. A. Seifert, and H. D. Hanes Jul. 1977 99 p refs
(Contract F33615-76-C-5100)
(AD-A053289; AFML-TR-77-107) Avail: NTIS HC A05/MF A01 CSCL 11/6

The feasibility of restoring the fatigue properties of fatigue damaged Ti-6Al-4V using hot isostatic processing (HIP) was investigated. Ti-6Al-4V specimens in the beta solution in a treated and over-aged condition were fatigue damaged to two levels of damage: just before crack initiation and after crack initiation. The fatigue specimens were coated with a Ti-6Al-4V coating after damage to isolate the surface cracks from the HIP atmosphere and cause them to be closed during HIP. Metallographic examination showed the cracks were not all bridged by the coating and these unbridged cracks did not close during HIP. Evidence was obtained to indicate the fatigue cracks which were bridged by the coating could be closed and bonded under appropriate conditions. The results of the fatigue damage, coating, and HIP experiments indicated that the total fatigue life of fatigue damaged specimens could be extended by coating and HIP, including specimens having surface fatigue cracks. Although the feasibility of the process has been demonstrated, further work to explore other coating procedures and more extensive fatigue testing is required to define the full potential and limitations of the process. Author (GRA)

N78-25173# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
INFLUENCE OF SUBSURFACE DEFECTS ON FATIGUE PROPERTIES OF TITANIUM ALLOYS Final Technical Report, 1 Mar. 1975 - 1 Mar. 1977
M. J. Blackburn and C. C. Law Jul. 1977 148 p refs
(Contract F33615-75-C-5138; AF Proj. 2306)
(AD-A052883; PWA-FR-8666; AFML-TR-77-112) Avail: NTIS HC A07/MF A01 CSCL 11/6

A program was conducted to evaluate the influence of two specific defects on the low cycle fatigue properties of selected alpha:beta titanium alloys. The formation of subsurface fatigue cracks and subsequent propagation to produce failure can lead to a characteristic fracture topography which has been designed a 'cleavage rosette'. This type of failure was first recognized in the alloy Ti-6Al-5Zr-0.5Mo-0.25 Si(IMI 685) beta processed to give a coarse acicular structure, in this case a very large fatigue debit is observed. The fatigue properties of IMI 685 determined under a range of stress amplitudes and frequencies are presented together with the results of detailed analysis of the chemistry of crack origins and fracture topography. Experiments to simulate rosette type failures by the introduction of artificial subsurface nucleation sites in IMI 685 and other alloys are described. Although some features of a rosette fracture could be reproduced, the magnitude of the fatigue debit was not. Models to account for the kinetic features of cracking in IMI 685 are proposed and compared with the experimental results. The second type of defect studied was a local structural heterogeneity, known as 'beta fleck', that can occur in incorrectly processed alpha:beta titanium alloys. The periodic chemical fluctuation responsible for regions of beta structure in an alpha:beta processed Ti-6Al-4V alloy are documented. Fatigue testing, under both stress and

strain control, have established that property-debits associated with beta flecks are only observed in specimens with surface residual stresses. The magnitude of this debit is dependent upon the specific test conditions. GRA

N78-25174# Ames Lab., Iowa.
FABRICATION OF SUPERCONDUCTING WIRE COMPOSITES BY DIRECTIONAL SOLIDIFICATION
J. D. Verhoeven, E. D. Gibson, D. Finnemore, and G. Ostenson Oct. 1977 39 p refs
(Contract W-7405-eng-82)
(IS-4280) Avail: NTIS HC A03/MF A01

A new process for producing composite Nb3Sn/Cu superconducting wires is reported. Evaluated were critical current densities and the stress dependence of critical currents. The process involves directional solidification of Cu-Nb or Cu-Nb-Sn alloys. ERA

N78-25175# Los Alamos Scientific Lab., N. Mex.
EXAMINATION OF COPPER OR NICKEL COATS W-BASE COMPOSITES
E. G. Zukas Nov. 1977 17 p
(Contract W-7405-eng-36)
(LA-7019-MS) Avail: NTIS HC A02/MF A01

Tungsten-base composites coated with either nickel or copper were heat-treated at elevated temperatures to produce a diffusion bond between the composite and the coat. At temperatures to 473 K, no diffusion bond was achieved and there was no improvement in low temperature ductility. At temperatures above 920 K, the coat and base bonded and the ductility was improved. Microprobe analysis confirmed that a diffusion bond formed. ERA

N78-25176# California Univ., Berkeley. Lawrence Berkeley Lab.
HEAT TREATMENT AND CHARACTERIZATION OF DUPLEX 1010 AND 1020 STEELS
M. J. Young Nov. 1977 73 p refs
(Contract W-7405-eng-48)
(LBL-6620) Avail: NTIS HC A04/MF A01

Tensile and impact properties of intermediately quenched and continuously annealed specimens were characterized and microstructural correlations established. The rule for two phase mixtures may be used as a fairly good approximation of the mechanical behavior of the duplex system, and improved correlations are possible with suitable modifications for the size, shape and distribution of the second phase. The property differentials between the duplex 1010 and 1020 at equal volume fractions of martensite are due mainly to the higher carbon content (hence, higher strength) of the 1020 martensite. Important metallurgical variables include subgrain formation, retained austenite, transformation twinning and martensite fraction. Of these, the volume fraction of martensite appears to be the most influential in controlling the strength, ductility and impact properties of the duplex systems studied. ERA

N78-25177# Oak Ridge National Lab., Tenn.
RESIDUAL ELEMENTS HAVE SIGNIFICANT EFFECTS ON THE ELEVATED-TEMPERATURE PROPERTIES OF AUSTENITIC STAINLESS STEEL WELDS
D. P. Edmonds, R. T. King, and G. M. Goodwin Jan. 1978 16 p refs
(Contract W-7405-eng-26)
(ORNL-TM-6177) Avail: NTIS HC A02/MF A01

The effects of B, P, Ti, C, S, and Si are studied. This work is aimed at developing austenitic stainless steel weld materials with enhanced elevated-temperature properties. The materials investigated include types 308, 316, and 16-8-2 stainless steel weld metals. Processes investigated include shielded metal-arc (SMA), gas tungsten-arc (GTA), and submerged-arc (SA) welding. Early work was done with type 308 and 316 SMA weld metals, where the greatest enhancement of properties resulted from controlled additions of boron, phosphorus, and titanium to the deposits. Significant improvements in the properties of GTA and SA welds also result from the addition of these residual elements. The optimum residual element composition were determined to be nominally 0.05 percent Ti, 0.04 percent P, and 0.006 percent B for SMA welds and 0.5 percent Ti, 0.04 percent P, and 0.006 percent B for GTA welds. Submerged-arc welds with 0.2 percent Ti have exhibited improved creep strengths. ERA

N78-25178# Addis Translations International, Portola Valley, Calif.
LECTURE SERIES: EASY INTRODUCTION TO PLATING THEORY
M. Ogata 9 Jan. 1978 12 p Transl. into ENGLISH from Jitsumu Hyomen Gijutsu (Japan), Oct. 1974 p 518-522 Prepared for Battelle Pacific Northwest Labs. Sponsored by DOE
(BNWL-TR-286) Avail: NTIS HC A02/MF A01

Questions of electroplating efficiency are closely connected with the deposition of metals and the generation of hydrogen. A lecture concerning the electrolysis of water and questions of electroplating is presented. ERA

N78-25179# Northeastern Univ., Boston, Mass. Inst. of Chemical Analysis, Applications, and Forensic Science.
DEVELOPMENT AND INITIAL CHARACTERIZATION OF AMORPHOUS METALS RICH IN W AND/OR Re
D. E. Polk and B. C. Giessen Nov. 1977 4 p refs
(Contract W-7405-eng-48)
(UCRL-13787) Avail: NTIS HC A02/MF A01

Studies were made in the following areas: preparation and characterization of high-density amorphous metals consisting of alloys of W and Re with metalloid element additions, preparation and characterization of alternate high-density amorphous metals consisting of alloys of Nb and Ta with transition metals, and participation in study of amorphous actinide metals based on U, Np, and Pu. ERA

N78-25180# Addis Translations International, Portola Valley, Calif.
SPECTRAL AND ENERGY ANALYSIS OF A MOVING ULTRASONIC SOURCE: APPLICATION TO THE ACOUSTIC EMISSION OF ALUMINUM SUBJECTED TO PLASTIC DEFORMATION
P. Fleischmann, F. Lakestani, and J. C. Baboux Nov. 1977 24 p refs Transl. into ENGLISH from Mater. Sci. Eng. (France), no. 3, 1977 p 205-212 Prepared for Lawrence Livermore Lab., Calif.
(UCRL-Trans-11299) Avail: NTIS HC A02/MF A01

The strain and grain size dependence of continuous acoustic emission spectra was investigated over a frequency range of 0.6 - 3.3 MHz in pure aluminum (99.99 percent). The plot of the emitted energy versus strain exhibited a maximum whose position depended on measurement frequency and grain size. To explain the experimental results, a model of an elementary event was developed. This model was based on a moving ultrasonic source whose dynamic characteristics were similar to those of the perturbation produced by the start and stop motion of a dislocation. Analyzing the position of the emitted energy maximum and the following energy decrease allowed one to relate the mean free path of dislocations to the grain size and amount of plastic deformation. The observed general tendency was an enhancement of higher frequencies of continuous emission spectra as deformation proceeds; this appeared as the result of a decrease in the duration of the elementary event, that was in the dislocation motion length. ERA

N78-25181# Oak Ridge National Lab., Tenn.
EFFECTS OF COMPOSITION VARIABLES ON THE TENSILE PROPERTIES OF TYPE 304 STAINLESS STEEL
M. K. Booker and V. K. Sikka Dec. 1977 40 p refs
(Contract W-7405-eng-26)
(ORNL-5353) Avail: NTIS HC A03/MF A01

Results of an analysis of the effects of grain size and chemical composition on the tensile properties of 20 heats of type 304 stainless steel are presented. Since the material involved all came from commercial heats, the ranges in composition of some elements are not wide enough to permit a clear delineation of the effects of those elements. Nevertheless, regression equations reflecting the effects of various variables were developed. These equations describe the data, whereas comparison with similar equations obtained by previous investigators yielded generally unsatisfactory results. In addition, the effects of carbon, nitrogen, and grain size were addressed in detail. Properties examined include 0.2 percent offset yield strength, ultimate tensile strength,

uniform elongation, total elongation, reduction in area, and low strain tensile stress-strain behavior. ERA

N78-25182# Oak Ridge National Lab., Tenn.
SURVEY OF AVAILABLE CREEP AND TENSILE DATA FOR ALLOY 800H
M. K. Booker, V. B. Baylor, and B. L. P. Booker Jan. 1978 178 p refs
(Contract W-7405-eng-26)
(ORNL-TM-6029) Avail: NTIS HC A09/MF A01

Most of the transition joints in the Clinch River Breeder Reactor Plant (CRBRP) will consist of trimetallic joints employing a spool piece (about 0.3 m long) of alloy 800H between 2 1/4 CR-1 Mo steel and austenitic stainless steel. It is, therefore, important that the mechanical properties of alloy 800H be well characterized and understood. Available creep and tensile data for this material, including analytical representations of behavior are summarized. ERA

N78-25183# Sandia Labs., Albuquerque, N. Mex. Physical Metallurgy Div.
DESIGNER'S GUIDE TO THE MECHANICAL PROPERTIES AND FRACTURE TOUGHNESS OF TITANIUM 6A1-6V-2SN
J. P. Hickerson Nov. 1977 65 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1202) Avail: NTIS HC A04/MF A01

During the design of the B77 laydown bomb, titanium 6A1-6V-2Sn was chosen for certain structural components. Comprehensive mechanical property and fracture toughness information for the alloy were lacking, necessitating a test program keyed to the anticipated weapon environment and stockpile-to-target sequence. Mechanical tests of strength, notch sensitivity, and fracture toughness that were conducted are reported. The results showed the duplex annealed condition to be most tough and least notch sensitive. It was found that any change in heat treatment, test temperature, or loading rate that boosted strength did so at the expense of fracture toughness and notch sensitivity. ERA

N78-25184# Los Alamos Scientific Lab., N. Mex.
PROCESS OF DEPOSITION OF FILMS OF AN INTERMETALLIC AND SUPERCONDUCTING COMPOUND OF NIOBIUM-TIN ON A BASE
1977 20 p refs Transl. into ENGLISH of French patent 1,558,715
(Contract W-7405-eng-36)
(LA-TR-77-91) Avail: NTIS HC A02/MF A01

The formation of an intermetallic zone during the deposition of Nb3Sn films on Hastelloy substrates may be prevented by placing a gaseous chloride or a bromide of niobium and of hydrogen in contact with the heated substrate, and depositing on the latter a niobium film by reduction of the chloride or bromide. The Nb3Sn film is then deposited on the niobium film. Author

N78-25185# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
INELASTIC ANALYSIS OF UNIAXIALLY LOADED UNIFORM SECTION 304 STAINLESS STEEL BASIC SPECIMENS
A. K. Dhalla Nov. 1977 160 p refs
(WARD-HT-3045-29) Avail: NTIS HC A08/MF A01

The inelastic analyses were performed using the MARC non-linear finite element general purpose computer program. Both product forms, 9.5 and 25.4 mm plates, were taken from the same reference heat 9T2796 Type 304 stainless steel material. The overall correlation of the predicted strains at the center of the specimen with the experimental observations is in reasonable agreement at low stress levels (stress less than 1.25 times the yield stress of the material). At higher stress levels the predicted creep rates are considerably lower than the rates observed in the experiment. The effects of prior creep hold time at these higher stress levels were quantified. The step-loaded specimens were exposed to elevated temperature for about 7000 hours, at stress levels up to one and a half times the yield stress of the material. A refinement of the failure predictions methods (based upon various damage hypotheses), as well as strain limit prediction are presented. ERA

N78-25186# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
EFFECTS OF HIGH TEMPERATURE SODIUM EXPOSURE ON THE MICROSTRUCTURAL AND TIME-DEPENDENT MECHANICAL BEHAVIOR OF TYPE 316 STAINLESS STEEL
W. E. Ray Dec. 1977 26 p refs
(Contract EY-76-C-02-3045-002)
(WARD-NA-3045-50) Avail: NTIS HC A03/MF A01

The mechanical properties of the materials used for these components will be affected by both the long term thermal aging and the corrosion caused by exposure to the sodium environment. In this program, Type 316 stainless steel samples were first pretreated for 5000 hours in both argon gas and decarburizing flowing sodium at temperatures of 649 C and 718 C. Mechanical properties tests were then conducted in flowing sodium at 593 C to evaluate the direction and magnitude of change in the low cycle fatigue, creep fatigue, and creep rupture properties of the pretreated samples. Creep rupture results indicated a significant increase in ductility coupled with a decrease in creep resistance with increasing pre-treatment temperature. Low cycle fatigue life at 593 C increased with increasing pretreatment temperature. ERA

N78-25187# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
MATHEMATICAL ANALYSIS OF THE ELEVATED-TEMPERATURE CREEP BEHAVIOR OF TYPE 304 STAINLESS STEEL M.S. Thesis - Tennessee Univ.
M. K. Booker Dec. 1977 225 p refs
(Contract W-7405-eng-26)
(ORNL-TM-6110) Avail: NTIS HC A10/MF A01

Using data gathered from various international sources, generalized regression techniques were used to develop analytical representations for various aspects of the creep behavior of type 304 stainless steel. These aspects include rupture life, minimum creep rate, time and strain to the onset of tertiary creep, creep-rupture ductility, and creep strain-time behavior. All models developed included analytical predictions of heat-to-heat variations in behavior as reflected by the ultimate tensile strength of a given heat of material. Such expressions yield a quantitative representation of the creep behavior of this material for design use. ERA

N78-25188# Sandia Corp., Albuquerque, N. Mex.
HYDROGEN EMBRITTLEMENT OF THERMOMECHANICALLY TREATED 18Ni MARAGING STEEL
J. W. Munford, H. J. Rack, and W. J. Kass 1977 11 p refs Presented at the Conf. on Environ. Degradation of Eng. Mater., Blacksburg, Va., 10 Oct. 1977
(Contract EY-76-C-04-0789)
(SAND-77-1087; Conf-771010-3) Avail: NTIS HC A02/MF A01

The influence of thermomechanical treatments on susceptibility to cracking in 100 percent relative humidity air and low pressure (93.3 KPa) gaseous hydrogen has been investigated for 18Ni (350 ksi) Maraging steel. Two thermomechanical treatments were studied, ausforming and marforming. A two to five fold increase in the stress intensity threshold for cracking was found for both the ausformed and marformed material. A dramatic difference in cracking kinetics was also apparent by the failure times at comparable stress intensities. Fractographic analysis showed that the primary fracture mode was 100 percent intergranular for the solution treated and aged samples while the ausform and marform failures were predominately quasi-cleavage or intergranular depending on orientation. Permeation and diffusion measurements were conducted on the above materials and these results are correlated with the environmental cracking behavior. ERA

N78-25189# Purdue Univ., Lafayette, Ind. School of Materials Engineering.
TRANSPORT AND THERMODYNAMIC PROPERTIES OF SOLIDS Final Report
R. E. Grace and M. A. Dayananda 30 Nov. 1977 33 p refs
(Contract EY-76-S-02-1436)
(COO-1436-48) Avail: NTIS HC A03/MF A01

During the last year of operation the principal area of research

has been ternary diffusion in solid solution alloys. Specific research projects deal with diffusion in the Cu-Ni-Zn and Fe-Ni-Al systems. Research activities in these areas are summarized. ERA

N78-25190# Illinois Univ., Urbana.
THERMODYNAMICS OF OXYGEN IN SOLID SOLUTION IN VANADIUM AND NIOBIUM-VANADIUM ALLOYS Ph.D. Thesis
G. L. Steckel 1977 128 p refs
(Contracts EY-76-C-02-1198; AT(11-1)-1198)
(COO-1198-1189) Avail: NTIS HC A07/MF A01

Investigations were made with a ThO2/Y2O3 electrolyte over the temperature ranges 700 to 1200 C (973 to 1473 K) for the binary system and 650 to 1150 C (923 to 1423 K) for ternary system. The activity of oxygen in vanadium obeys Henry's law for temperatures and concentrations up to 3.2 at. percent oxygen. For higher concentrations, the activity coefficient shows positive deviations from Henry's law. The terminal solubility of oxygen in vanadium was determined. The activity of oxygen in Nb-V alloys obeys Henry's law for temperatures and oxygen concentrations less than approximately 2 at. percent. For certain Nb/V ratios, Henry's law is obeyed for concentrations as high as 6.5 at. percent oxygen. First order entropy and enthalpy interaction coefficients have been determined to describe the effect on the oxygen activity of niobium additions to vanadium-rich alloys with dilute oxygen concentrations. ERA

N78-25191# Cornell Univ., Ithaca, N. Y. Materials Science Center.
IN-SITU FIELD-ION MICROSCOPE STUDY OF THE RECOVERY BEHAVIOR OF HEAVY METAL ION-IRRADIATED TUNGSTEN, TUNGSTEN (RHENIUM) ALLOYS AND MOLYBDENUM M.S. Thesis
C. H. Nielsen Jun. 1977 84 p refs
(Contract EY-76-S-02-3158)
(COO-3158-60) Avail: NTIS HC A05/MF A01

Field ion microscope (FIM) experiments were carried out to study the annealing behavior of heavy iron irradiated tungsten, tungsten (rhenium) alloys, and molybdenum. The first experiment dealt with the stage 1 long-range migration of tungsten self interstitial atoms (SIAs) in high purity tungsten of resistivity ratio. The FIM specimens were irradiated and, subsequently, examined by the pulsed-field evaporation technique. The second experiment dealt with the phenomenon of impurity atom trapping of SIAs during long-range migration. It was shown that rhenium atoms in a tungsten matrix tend to capture tungsten SIAs and remain bound up to temperatures as high as 390 K. The final experiment was concerned with the low temperature annealing kinetics of irradiated molybdenum. The results indicated that the electric field has only a minimal effect on the SIA annealing kinetics. ERA

N78-25192# California Inst. of Tech., Pasadena. Div. of Engineering.
STUDIES OF ALLOY STRUCTURES AND PROPERTIES Annual Summary Report, 1 Dec. 1976 - 1 Dec. 1977
P. Duwez 1977 25 p refs
(Contract EY-76-C-03-0822)
(CALT-822-98) Avail: NTIS HC A02/MF A01

Brief summaries of research activities in the following areas are given: superconductivity to ferromagnetism in amorphous Gd La-Au alloys; magnetic regimes in amorphous Ni-Fe-P-B alloys; electronic and magnetic properties of amorphous gadolinium based ferromagnets; Kondo effect, spin correlations, and superconductivity in amorphous alloys doped with magnetic impurities; flux pinning by crystalline phase precipitates embedded in an amorphous superconducting matrix, kinetics of crystallization of amorphous alloys; properties of the flux lattice in amorphous super-conductors; low temperature calorimeter; low temperature heat capacity of metastable superconductors; thermal relaxation effects and crystallization of amorphous alloys; fundamental studies of amorphous superconductors using superconductive tunneling; low temperature calorimetry of bulk amorphous metals; and micromagnetism in amorphous alloys. ERA

N78-25193# Bettis Atomic Power Lab., West Mifflin, Pa.
SUSCEPTIBILITY OF UNIRRADIATED RECRYSTALLIZED ZIRCALOY-4 TUBING TO STRESS CORROSION CRACKING (LWBR DEVELOPMENT PROGRAM)
N. W. Polan and R. P. Tucker Dec. 1977 47 p refs
(Contract EY-76-C-11-0014)
(WAPD-TM-1313) Avail: NTIS HC A03/MF A01

Stress corrosion cracking (SCC) in unirradiated recrystallized Zircaloy-4 internally pressurized tubing specimens in atmospheres containing iodine vapor, cesium, or combinations of iodine and cesium is evaluated experimentally in terms of the effects of internal surface flaw morphology, iodine and cesium concentrations, tubing hydrogen content, test temperature, and test atmosphere water vapor content on the time to failure. The iodine vapor SSC data are analyzed in the framework of a fracture mechanics model. Expressions are developed which relate the iodine SSC threshold stress and lifetime for stresses above threshold to temperature, iodine concentration, and surface flaw geometry. ERA

N78-25194# Battelle Columbus Labs., Ohio.
EVALUATING STRENGTH AND DUCTILITY OF IRRADIATED ZIRCALOY, TASK 5 Quarterly Progress Report, Jul. - Sep. 1977
A. A. Bauer, W. J. Gallagher, L. M. Lowry, and A. J. Markworth Oct. 1977 36 p refs
(Contract W-7405-eng-92-061)
(BMI-NUREG-1985) Avail: NTIS HC A03/MF A01

Isothermal tube-burst test results obtained on spent-fuel cladding are reported. Included are test results obtained as a function of temperature and as a function of strain rate (constant volume-rate test) at 700 F. The effects of transient and isothermal annealing on tube burst properties also are presented. Analysis of isothermal-annealing, tensile-test data indicate a first-order time dependence for the annealing kinetics with an activation energy similar to that for zirconium self-diffusion. Transient tube-burst tests of the cladding, conducted at initial pressures ranging from 2100 to 10,500 kPa, produced burst temperatures and burst ductility measurements similar to those recorded for unirradiated Zircaloy tubing. Differences in burst temperature are associated with axial restraint during the tube ballooning and failure stages were observed on tube burst behavior. ERA

N78-25195# Los Alamos Scientific Lab., N. Mex.
PROCESS OF PRODUCING FILMS FROM A NIOBIUM-TIN INTERMETALLIC SUPERCONDUCTING COMPOUND
Siemens Aktiengesellschaft 1977 11 p Transl. into ENGLISH from French patent no. 1536474, 8 Jul. 1968 11 p Sponsored by DOE
(LA-tr-77-92) Avail: NTIS HC A02/MF A01

A procedure for fabricating Nb3Sn films by vapor deposition is described which avoids the formation of NbCl3 precipitates. ERA

N78-25196# National Technical Information Service, Springfield, Va.
FERROUS METALS CASTING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1978
Mona F. Smith Mar. 1978 226 p Supersedes NTIS/PS-77/0246; NTIS/PS-76/0142; NTIS/PS-75/223
(NTIS/PS-78/0287; NTIS/PS-77/0246; NTIS/PS-76/0142; NTIS/PS-75/223) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

Federally sponsored research covered includes casting processes, heat treatment, quality control, solidification, microstructure, mechanical properties, additives, and purification. Studies are included on casting and its involvement in scrap reuse, air pollution, and tool manufacture. An updated bibliography containing 221 abstracts is presented. Author

N78-25197# National Technical Information Service, Springfield, Va.
FERROUS METAL CASTING, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1976 - Mar. 1978
Mona F. Smith Mar. 1978 336 p Supersedes NTIS/PS-77/0248
(NTIS/PS-78/0288; NTIS/PS-77/0248) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

Worldwide research is cited on iron and steel continuous casting, die casting, and precision casting. Studies on molds,

mold release agents, shrinkage, solidification, defects, and additives are included. An updated bibliography containing 329 abstracts is presented. Author

N78-25198# Bureau of Mines, Washington, D. C.
LEAD, 1977
J. Patrick Ryan and John M. Hague Dec. 1977 28 p refs (PB-277501; BM-MCP-9) Avail: NTIS HC A03/MF A01 CSCL 11F

Lead is one of the most useful and essential metals in the service of man. Of the nonferrous metals, in terms of tonnage used, it ranks after aluminum, copper, and zinc. Its major uses are storage batteries for automobiles and battery powered vehicles, as an antiknock additive in gasoline, and in materials for the construction industry. The United States has the largest reserves of lead and has been the leading lead producing country for several years. Comprehensive data are presented for the commodity including background material on industry structure, reserves and resources, technology, supply and demand relationships, byproducts and coproducts, strategic considerations, economic factors and problems, environmental considerations, operating factors and problems, and outlook to 2000. Author

N78-25199# Nationaal Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).
HEAT TREATMENT STUDIES OF ALUMINUM ALLOY TYPE 7050 FORGINGS. THE EFFECT OF HEAT TREATMENT ON A VARIETY OF ENGINEERING PROPERTIES Interim Report
L. Schra and H. P. vanLeeuwen 19 Jan. 1976 131 p (NLR-TR-76008-U; IR-2) Avail: NTIS HC A07/MF A01

The effect of variety of heat treatments on various engineering properties was studied with the aim to derive an optimum heat treatment. The engineering properties comprised Vickers hardness, short-time tensile strength, fatigue crack propagation resistance, fracture toughness and stress corrosion resistance. The test results were compared with those obtained in earlier investigations on the older forging alloys of American and British origin 7079 and DTD 5024 and on the newly developed German forging alloy AZ74.61. The performance of the alloy 7050 proved to be generally superior to that of AZ74.61 and far superior to that of 7079 and DTD 5024. However, it was found that quenching in boiling water leads to relatively inferior fracture toughness and stress corrosion properties, while in the SCC resistant condition the alloy proved to be very susceptible to general corrosive attack if exposed to an aggressive environment. Author

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N78-25200*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
ANALYSIS OF SURFACE TRIS (2,3-DIBROMOPROPYL) PHOSPHATE ON CHLOROBUTYL RUBBER SCAPE SUITS
Thomas A. Schehl, Helein D. Bennett, Coleman J. Bryan, and Charles W. Bright May 1978 29 p refs (NASA-TM-79731; MAS-7100) Avail: NTIS HC A03/MF A01 CSCL 11G

Tris (2,30-dibromopropyl) phosphate was used to confer flame retardant properties on butyl rubber formulations used in protective clothing such as the self-contained atmospheric protective ensembles (SCAPE suits) worn at Kennedy Space Center in support of Apollo, Skylab, and Apollo-Soyuz missions since 1966. Because tris (2,3-dibromopropyl) phosphate is mutagenic, surface concentrations of the compound in SCAPE suits were investigated as were as potential methods of removing or isolating it. Analytical procedures for determining surface concentrations of the tris compound on non-porous materials are described. Soap-and-water washing is the most efficient method of removing the compound from fabricated SCAPE suits and unused material. Author

N78-25201# Bayer A. G., Leverkusen (West Germany). Plastics and Coating Div.
THE ECONOMICS OF PLASTICS FOR THE AUTOMOTIVE INDUSTRY
P. R. Muller [1977] 31 p Presented at 1st South African Conf. on Plastics in the Serv. of Man
Avail: NTIS HC A03/MF A01

A discussion on the economics of plastic usage in the automobile industry is presented. Various automobile components are reviewed and pictured to illustrate the usage of plastics. Comparisons are made between several of the automobile producing nations and their utilization of plastics in their products. G.Y.

N78-25202# Fibreglass Filaments (Pty) Ltd. (South Africa).
THE IMPACT OF REINFORCED PLASTIC COMPOSITES ON THE AUTOMOTIVE INDUSTRY
E. A. Pears [1977] 19 p refs Presented at the First S. African Conf. on Plastics in the Serv. of Man
Avail: NTIS HC A02/MF A01

Material and process development in respect of both thermoset and thermoplastic compounds are discussed. Also examined are developments associated within the automotive industry on an international basis, and discussion on their importance relative to the South African industry. Author

N78-25203# General Electric Plastics B. V., Bergen op Zoom (Netherlands).
MODERN PLASTICS FOR THE AUTOMOTIVE ENGINEER
J. Bussink and M. H. Radley [1977] 20 p Presented at 1st South African Conf. on Plastics in the Serv. of Man
Avail: NTIS HC A02/MF A01

Utilizing the properties of engineering thermoplastics provides the answer to many problems confronting the automotive designer today. Many large parts are now becoming possible including vehicle front ends where part integration and value engineering can be used to maximum benefit. Tomorrows vehicles will certainly utilize larger moldings and there will be increased use of engineering structural foam. Developments are already under way to make complete rear door assemblies, truck cabs, and public service vehicle interiors. P.R.A.

N78-25204# Ciba-Geigy (Pty) Ltd., Biel (Switzerland). Plastics Sub-Div.
EPOXY RESINS IN THE ELECTRICAL INDUSTRY: APPLICATION, PROCESSING AND PROPERTIES
J. Boetschi [1977] 24 p refs Presented at the First S. African Conf. on Plastics in the Serv. of Man
Avail: NTIS HC A02/MF A01

The reliability of epoxy resins as electrical insulating materials has been demonstrated by long term service. The use of cast components for measuring or distribution tranformers, for switchgear, and outdoor equipment is discussed along with design and manufacturing aspects of these devices. Casting techniques are examined and the influence of the reaction shrinkage and the processing techniques on internal mechanical stresses and electrical behavior is explained. The automatic pressure gelation process (ATP) is suggested as the obvious answer to many casting problems. Author

N78-25205# Asea Electric (South Africa) Ltd. Cable Div.
ELECTRIC CABLE
B. Stromnes [1977] 14 p Presented at the First S. African Conf. on Plastics in the Serv. of Man
Avail: NTIS HC A02/MF A01

The status of polymer materials as used in the cable industry is reviewed. Applications for insulation and protection of cables are emphasized. Manufacturing techniques and application areas of electric cables are included. Author

N78-25206# Bayer A. G., Leverkusen (West Germany). Plastics and Coatings Div.
ENGINEERING PLASTICS IN THE ELECTRICAL INDUSTRY
P. R. Mueller [1977] 22 p Presented at 1st South African Conf. on Plastics in the Serv. of Man
Avail: NTIS HC A02/MF A01

The application of thermoplastic materials in the electrical

industry is examined. Areas covered included domestic appliances, office equipment, lighting, radio and television, production and distribution of electrical energy, and telecommunications. Emphasis is placed on the insulating properties of the plastics. Safety regulations are also considered. J.M.S.

N78-25207# Plastomark (Pty) Ltd. (South Africa).
HDPE AND PP IN PACKAGING
H.-G. Sala [1977] 10 p Presented at the 1st S. African Conf. on Plastics in the Serv. of Man
Avail: NTIS HC A02/MF A01

The characteristics and uses of plastics, polyethylene and polypropylene in the packaging industry are discussed. Major emphasis is given to the use of plastic containers by the food industry, the fishing industry and industry in general. Also discussed are the uses and characteristics of plastics used in the manufacturing of twine and strapping. G.Y.

N78-25208# Van Leer S. A. (Pty) Ltd., Springs (South Africa).
THERMAL STRESS CRACKING IN ORIENTATED CROSS-PLY LAMINATED POLYETHYLENE
S. C. Shea [1977] 22 p refs Presented at 1st South African Conf. on Plastics in the Serv. of Man
Avail: NTIS HC A02/MF A01

The dominant feature in thermal stress cracking is strain as shown by creep curves of homo and copolymers. Copolymers exhibit excellent stress homopolymers under conditions of identical stress and time. In the case of oriented homopolymers cross-ply laminates, defects are introduced into the film during the drawing process which subsequently act as stress concentrators. As a result of this a point may be reached where the yield stress of the material is exceeded, resulting in redrawing and bridging fibrils forming across the crack. While copolymer films were found to exhibit similar defects, the stress concentration factor was in all cases found to be lower than that of homopolymers, and consequently, redrawing was not observed. Author

N78-25209# South African Bureau of Standards, Pretoria. Packaging Div.
PERFORMANCE TESTING OF INDUSTRIAL PLASTICS PACKAGES
R. G. Titlestad [1977] 19 p refs Presented at the First S. African Conf. on Plastics in the Serv. of Man
Avail: NTIS HC A02/MF A01

The following six (6) categories of industrial plastics packages are discussed: (1) Grain bags and bags for milled grain (woven bags); (2) Polyethylene sacks made of film extruded in tubular form; (3) Self-supporting plastics containers, including drum types and openhead containers; (4) Plastics crates; (5) Plastics blow-moulded bottles packed in outer containers; and (6) Plastics pallets -- in relation to the performance testing criteria specified for these containers, when used for the packaging and distribution of general goods, and where applicable, dangerous goods. Cognizance is taken of national and international transportation packaging requirements, and national specifications. Author

N78-25210# Shell Chemical South Africa (Pty) Ltd., Johannesburg.
POLYSTYRENE AND ITS USE IN THE PACKAGING INDUSTRY
N. R. Mayne [1977] 23 p Presented at the First S. African Conf. on Plastics in the Serv. of Man
Avail: NTIS HC A02/MF A01

The three main forms of polystyrene, namely solid (crystal clear or toughened), foamed and expanded are used in a wide variety of packaging applications. The typical properties and potential of this versatile plastic are described in relation to synthetic and natural materials in terms of both technical merit and other factors. New developments in grade tailoring and processing techniques such as co-extrusion and ultra-thin wall mouldings are highlighted and growth areas identified. Author

N78-25211# AECI Ltd., Johannesburg (South Africa). Commercial Dept.
PLASTICS FROM THE USER'S POINT OF VIEW
R. D. Gillespie 14 Jul. 1977 16 p Presented at 1st South African Conf. on Plastics in the Serv. of Man
Avail: NTIS HC A02/MF A01

Various plastic packs and accessories used for chemicals, explosives and agricultural products are reviewed. The type of pack being used and the procedures which have been developed for filling, handling and distributing products so packed are discussed. Author

N78-25212# Metal Box (South Africa) Ltd. Plastics Div.
THE PACKAGING OF FOODSTUFFS IN RIGID AND SEMI-RIGID PACKAGING
T. Evans [1977] 18 p Presented at the First S. African Conf. on Plastics in the Serv. of Man
Avail: NTIS HC A02/MF A01

Packaging requirements of various foodstuffs are discussed in terms of utilizing plastic packaging materials. Factors considered include processing techniques, shelf-life, and filling, sealing, and handling qualities. J.M.S.

N78-25213# AECI Ltd., Johannesburg (South Africa). Plastics Technical Service Lab.
PLASTICS: THE ROLE OF CONSERVATION AND RECYCLING
D. J. Tanner [1976] 18 p refs Presented at the 1st S. African Conf. on Plastics in the Serv. of Man
Avail: NTIS HC A02/MF A01

The technical and economic scenario of plastics conservation and recycling is described. The consumption of plastics is first discussed and packaging is shown to be the largest market sector and also the major constituent of plastic waste. Various policies for plastics waste are briefly discussed as alternatives to conservation and recycling. It is suggested that conservation can operate in two ways: either goods of higher quality and long lifetimes are produced, or the consumption of unnecessary goods is reduced. Recycling possibilities for plastics are discussed in terms of the processes which could be required in a plastics recycling industry. The differing interest of industry and the community in matters of the environment are discussed. The aims, recycling, and conservation are discussed in terms of costs and benefits to industry and the community. Author

N78-25214# South African Bureau of Standards, Pretoria.
THE ECONOMIC BENEFITS OF DESIGN IN THE PRODUCTION OF PLASTIC PRODUCTS
Richard Collins [1977] 17 p refs
Avail: NTIS HC A02/MF A01

The nature of the design process in industry is discussed and illustrated in general terms within the historical perspective. The benefits to the converter, the consumer, and the community, which result from the appropriate use of design methodology are reviewed. Particular emphasis is placed on designing for consumer needs, the judicious selection and use of materials and processes to meet both economic and aesthetic constraints, and the need for the plastics industry to give increasing attention to the creation of consumer awareness of these factors. The responsibility of the plastics industry to employ sound design techniques to ensure the appropriate use of plastics materials in product specifications is underlined. Author

N78-25215*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRESSURELESS SINTERED SIALONS WITH LOW AMOUNTS OF SINTERING AID
Alan Arias Jun. 1978 16 p refs
(NASA-TP-1246; E-9522) Avail: NTIS HC A02/MF A01 CSCL 11G

Two Beta prime - Sialons of composition Si2.6Al0.393y0.00700.4N3.6 and Si2.6Al0.384Y0.01400.4N3.6 were pressureless sintered from mixtures of Y2O3 and separately milled Beta -Si3N4, AlN, and SiO2. These Sialons had densities of over 98% of theoretical, four-point bend strengths of 460 and 155 MPa at room temperature and 1400 C, respectively, and 1400 C oxidation rates lower than those reported for hot pressed Si3N4 and for a stronger Sialon with 2.5 weight percentage Y2O3. Author

N78-25216*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
HEAT RESISTANT POLYMERS OF OXIDIZED STYRYLPHOSPHINE Patent Application

Kazimiera Paciorek, inventor (to NASA) (Ultrasystems, Inc., Irvine, Calif.) Filed 19 May 1978 34 p Sponsored by NASA
(NASA-Case-MSC-14903-2; US-Patent-Appl-SN-907435) Avail: NTIS HC A03/MF A01 CSCL 07C

Homopolymers, copolymers, and terpolymers of a styrene based monomer were prepared by: (1) polymerizing at least one oxidized styrylphosphine monomer selected from the group of: (C6H5) 2 P (O)N = P(C6H5]2 C6H4CH = CH2, (C6H5O)2 P(O)N = P(C6H5)2 C6H4CH = CH2, (C6H5O)2 C3N3N = P(C6H5)2 C6H4CH = CH2, and (C6H5)C3N3 [N = P(C6H5)2 C6H4C-H = CH2]2; or (2) polymerizing p-diphenyl phosphine styrene and then oxidizing said polymerized p-diphenyl phosphine styrene monomer with an organoazide selected from the group of (C6H5)2 P(O)N3, (C6H5O)2 P(O)N3, (C6H5)2 C3N3(N3), and C6H5C3N3 (N3)2. Copolymers can also be prepared by copolymerizing styrene with at least one oxidized styrylphosphine monomer. NASA

N78-25217*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
HEAT RESISTANT POLYMERS OF OXIDIZED STYRYL-PHOSPHINE Patent Application
Kazimiera Paciorek, inventor (to NASA) (Ultrasystems, Inc., Irvine, Calif.) Filed 19 May 1978 35 p Sponsored by NASA
(NASA-Case-MSC-14903-3; US-Patent-Appl-SN-907479) Avail: NTIS HC A03/MF A01 CSCL 07C

Flame resistant, non-toxic vinyl polymers which contain phosphazene groups are presented. These polymers did not emit any toxic or corrosive products when they were oxidatively degraded. NASA

N78-25218*# National Aeronautics and Space Administration. Pasadena Office, Calif.
HIGH TEMPERATURE RESISTANT CERMET AND CERAMIC COMPOSITIONS Patent Application
Wayne M. Phillips, inventor (to NASA) (JPL) Filed 8 Dec. 1977 28 p Sponsored by NASA
(NASA-Case-NPO-13690-2; US-Patent-Appl-SN-858766) Avail: NTIS HC A03/MF A01 CSCL 11B

Particles of high temperature resistant metal or metal alloy are mixed with a mixture of ceramic components, applied to a substrate, and hot pressed and sintered at temperatures ranging from 1,700 to 2,000 C, at pressures of 1,000 to 10,000, for a period of 10 to 60 minutes. A ceramic solid solution which coats and bonds the metal particles to the ceramic solid solution matrix is formed. Properties of the cermet body include: high temperature oxidation resistance; good abrasion and wear resistance; low coefficient of friction; high hardness; and biocompatibility. Areas of application include: seals for thermionic converters; production of turbine blades; reentry shields for space vehicles; and medical implants for rebuilding bones and joint structures of the body. NASA

N78-25219*# National Aeronautics and Space Administration. Pasadena Office, Calif.
HIGH TEMPERATURE RESISTANT CERMET AND CERAMIC COMPOSITIONS Patent Application
Wayne M. Phillips, inventor (to NASA) (JPL) Filed 8 Dec. 1977 28 p Sponsored by NASA
(NASA-Case-NPO-13690-3; US-Patent-Appl-SN-858761) Avail: NTIS HC A03/MF A01 CSCL 11B

A high temperature oxidation resistant cermet having a high hardness is described, which can be adapted for use as cermet seals for thermionic converters, as well as for turbine blades, reentry shields for space vehicles, and for medical implants for rebuilding bones. The cermet composition is obtained by mixing particles of high temperature resistant metal or metal alloy such as molybdenum with a mixture of ceramic components. NASA

N78-25220# Systems Research Labs., Inc., Dayton, Ohio. Research Applications Div.
DYNAMIC EVALUATION OF EXPERIMENTAL INTEGRAL FUEL TANK SEALANTS Final Technical Report, Feb. 1976 - Jun. 1977
William R. Mallory and Elmer V. Harbert, Jr. Wright-Patterson AFB, Ohio AFML Aug. 1977 21 p
(Contract F33615-76-C-5253; AF Proj. 2421; AF Proj. 7340) (AD-A053335; SRL-6901; AFML-TR-77-152) Avail: NTIS HC A02/MF A01 CSCL 11/1

Research was performed to evaluate the sealant properties of elastomeric materials under simulated in-service conditions. Unique equipment has been designed and fabricated for the evaluation of a variety of joint configurations. The equipment consists primarily of a biaxial stress machine with programmable environmental exposure during evaluation. Variables include frequency and amplitude of the independently driven and recorded strains, temperature, pressure and fuel/fuel vapor exposure. Specimens can be strained torsionally and longitudinally during thermal and fuel fill cycles to simulate actual flight conditions.
Author (GRA)

N78-25221# Bendix Corp., Kansas City, Mo.
GLASS MICROBUBBLE COMPOSITE FOAM
H. M. McIlroy Feb. 1978 22 p refs Revised
(Contract EY-76-C-04-0613)
(BDX-613-1596-Rev) Avail: NTIS HC A02/MF A01

Composite foams were prepared from blends of Kerimid 601 polyamide resin and different types of glass microbubbles. Kerimid 601 is an addition type polyimide that offers many processing advantages over other types of polyimides. In an addition reaction, no volatiles are evolved during cure and weight loss, and shrinkage during cure is small. Also, since the resin is a powder that melts and flows before curing, low density foams can be prepared. Processes were developed to blend, mold, and cure the foam formulations. The powered resin and glass microbubble were mixed together in a twin shell blender. Three methods of molding were considered: a sintering process, vacuum bag molding, and compression molding; however, all of the foams were made by the vacuum bag method. The standard cure recommended was used to cure and postcure the foam samples. ERA

N78-25222# General Cable Corp., Union, N. J.
CABLE NEUTRAL CORROSION SELECTION AND EVALUATION OF SEMICONDUCTING THERMOPLASTIC JACKET COMPOUNDS FOR CONCENTRIC NEUTRAL URD PRIMARY CABLES, PHASE 1 Final Report
George Bahder, George S. Eager, Rudolph G. Lukac, Gertraud A. Schmidt, and David A. Silver Dec. 1977 101 p refs
(EPRI Proj. 671-1)
(EPRI-EL-619-Vol-1) Avail: NTIS HC A06/MF A01

Results of a project pertaining to the selection and evaluation of semiconducting thermoplastic compounds for use as a corrosion protective overall jacket on concentric neutral underground residential distribution (URD) primary cables are presented. The project consisted of compound screening and a six month accelerated aging test program of full size 15kV cables. Eleven semiconducting thermoplastic compounds received from six compound manufacturers were subjected to the screening test program. Six compounds were accepted for further testing. Accelerated aging of full size 15kV cables, jacketed with each of the six approved compounds took place with exposure in 100 C air oven, exposure in 75 C tap water, or burial in three soils with and without ac test voltage applied between the copper concentric neutral conductor and ground. Measurements of physical properties and radial resistance and capacitance of the semiconducting jacket compounds were performed initially and at regular intervals during the course of the test program.
ERA

N78-25223# General Cable Corp., Union, N. J.
CABLE NEUTRAL CORROSION. PHASE 2: OUTDOOR HIGH VOLTAGE AND HIGH CURRENT SHORT CIRCUIT TESTS ON SINGLE PHASE EXTRUDED DIELECTRIC PRIMARY DISTRIBUTION OF CABLES Final Report
George Bahder, M. A. Martin (Georgia Power Co.), N. Piccione (Long Island Lighting Co.), J. B. Prime, Jr. (Florida Power and Light Co.), and David A. Silver Dec. 1977 93 p refs
(EPRI Proj. 671-1)
(EPRI-EL-619-Vol-2) Avail: NTIS HC A05/MF A01

Severe deterioration of the concentric neutral conductor as a result of corrosion presents a problem of serious concern to power and communication companies as well as to other utilities using direct buried metallic facilities. The objective of this project was to establish the performance of insulating-type and semiconducting jacketed concentric neutral cables in comparison with bare copper concentric neutral cable under fault conditions

from the standpoint of transient voltage gradients developed in the earth. It was considered that data generated in this project could be employed as substantiation for a change in the National Electrical Safety Code to permit the use of jacketed concentric neutral cable in joint-random installation with communication cable in locations corrosive to bare copper. The tests encompassed staged and prestaged fault tests on direct buried, 15 kV and prestaged fault tests on direct buried, 35 kV crosslinked polyethylene insulated cables of various concentric neutral conductor designs without jackets; insulating and semiconducting jackets were included as dictated by good design practices. ERA

N78-25224# National Bureau of Standards, Washington, D. C. Inorganic Materials Div.
DEVELOPMENT, TESTING, AND EVALUATION OF MHD-MATERIALS Quarterly Report, Apr. - Jun. 1977
H. P. R. Frederikse, T. Negas, and S. J. Schneider 30 Jun. 1977 80 p refs
(Contract EA-77-A-01-6010-035; Contract E(49-1)-3800)
(FE-6010-2) Avail: NTIS HC A05/MF A01

Electrode design and fabrication as well as post-test characterization were studied. Several methods for joining the ceramic to the metal base were considered, including a thick cermet layer and a mechanical attachment. A series of 11 anode cathode pairs were fabricated for a test in a generator under slagging conditions. The large volume of viscosity data collected were analyzed and presented in the form of a comparison with a base slag composition. In the assessment of alloys for downstream components attention was focused on mechanical strength and resistance to H2S attack. Author

N78-25225# Cities Service Oil Co., Tulsa, Okla.
EL DORADO MICELLAR-POLYMER DEMONSTRATION PROJECT REPORT Annual Report, Jun. 1976 - Aug. 1977
G. W. Rosenwald, ed., R. J. Miller, ed., and J. Vairogs, ed. Feb. 1978 296 p
(Contract EY-76-C-02-4100)
(BERC/TPR-77/12; AR-3) Avail: NTIS HC A13/MF A01

The El Dorado Demonstration Project is designed to allow a side-by-side comparison of two distinct micellar-polymer processes in the same field so that the reservoir conditions for the two floods are as nearly alike as possible. Selection of sulfonates and polymers for both patterns was completed. Salinity changes in produced fluids and in observation well samples have shown that breakthrough of preflush (or preflood) has occurred at some wells in both patterns. Observation well sampling and logging data showed that preflush arrived earlier at the observation wells in the north pattern than the south pattern. Injectivities of the micellar system designed for the south pattern and components of that system were tested in three monitoring wells. Similarly, extensive injectivity testing of the surfactant and polymer slugs designed for the north pattern was conducted using two monitoring wells. ERA

N78-25226# Gary Operating Co., Englewood, Colo.
BELL CREEK FIELD MICELLAR-POLYMER PILOT DEMONSTRATION Annual Report, Jul. 1976 - Sep. 1977
Arnold Goldburg 1978 168 p refs
(Contract EY-77-C-02-4207)
(BERC/TPR-77/13; COO-4207-15) Avail: NTIS HC A08/MF A01

A pilot demonstration is being conducted to determine whether micellar-polymer flooding is an economically feasible technique for enhanced oil recovery from the Muddy Sand Unit, A Reservoir of the Bell Creek Field, Powder River and Carter Counties, Montana. During the first year of this project extensive reservoir studies, site and pattern selection, design and selection of an optimal micellar-polymer system, water flood history matching and preliminary process simulations by numerical models, and development of pilot injection and production wells were completed. The major effort during the first contract year was the design for the Bell Creek pilot of two optimal micellar-polymer processes - one oil external and one water-external; and the concomitant development of a selection methodology by which to decide upon the more suitable process by means of a standard set of laboratory experiments and numerical simulations. This effort was completed. ERA

N78-25227# Los Alamos Scientific Lab., N. Mex.
STATE OF THE ART: ALUMINA CERAMICS FOR ENERGY APPLICATIONS
W. E. Hauth and S. D. Stoddard Jan. 1978 16 p refs
(Contract W-7405-eng-36)
(LA-7063-MS) Avail: NTIS HC A02/MF A01

Prominent ceramic raw materials and product manufacturers were surveyed to determine the state of the art for alumina ceramic fabrication. This survey emphasized current capabilities and limitations for fabrication of large, high-density, high-purity, complex shapes. Some directions are suggested for future needs and development. ERA

N78-25228# National Technical Information Service, Springfield, Va.
MAGNESIUM OXIDE CERAMICS AND REFRACTORIES, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1974 - Mar. 1978
Mona F. Smith Mar. 1978 229 p Supersedes NTIS/PS-77/0208; NTIS/PS-76/0215 2 Vol.
(NTIS/PS-78/0249; NTIS/PS-77/0208; NTIS/PS-76/0215) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 11C

Worldwide research is cited on sintering, structure, mechanical properties, strength, degradation, phase studies, additives, and uses of these materials. (This updated bibliography contains 222 abstracts, 67 of which are new entries to the previous edition.) GRA

N78-25229# National Technical Information Service, Springfield, Va.
MAGNESIUM OXIDE CERAMICS AND REFRACTORIES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1978
Mona F. Smith Mar. 1978 213 p Supersedes NTIS/PS-77/0207; NTIS/PS-76/0213 2 Vol.
(NTIS/PS-78/0248; NTIS/PS-77/0207; NTIS/PS-76/0213) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 11C

Federally-funded research is cited on the structure, deformation, mechanical properties, fabrication, radiation effects, tests, and thermodynamic properties. Studies on phase diagrams, diffusion, and electrical, high temperature, and nuclear reactor applications are also presented. (This updated bibliography contains 208 abstracts, 23 of which are new entries to the previous edition.) GRA

N78-25230# National Technical Information Service, Springfield, Va.
FRACTURE OF CERAMICS, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964-1976
Mona F. Smith Mar. 1978 255 p
(NTIS/PS-78/0263) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 11B

Citations of research on ceramic fracture in relation to fabrication, microstructure, mechanical properties, tests, and composition are covered in this bibliography. Reports include ceramic use in rocket components, gas turbines, nuclear reactors and structural parts. Author

N78-25231# National Technical Information Service, Springfield, Va.
FRACTURE OF CERAMICS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - Mar. 1978
Mona F. Smith Mar. 1978 85 p Supersedes NTIS/PS-77/0216; NTIS/PS-76/0198; NTIS/PS-75/217
(NTIS/PS-78/0264; NTIS/PS-77/0216; NTIS/PS-76/0198; NTIS/PS-75/217) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 11B

For abstract, see N78-25230.

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N78-25232# Indian Inst. of Science, Bangalore. High-Energy Solids Lab.
AGING STUDIES ON SOLID PROPELLANTS: A REVIEW
K. Kishore and G. Prasad 9 Feb. 1978 56 p refs Backup document for AIAA Synoptic, "A Survey of Solid Propellant Aging Studies", scheduled for publication in Journal of Spacecraft and Rockets in Sep. - Oct. 1978
Avail: NTIS HC A04/MF A01

Real (or normal) and accelerated aging tests of solid propellants are discussed. Topics covered include failure criteria, estimation of safe life, changes in ballistics and mechanical properties during aging, and the mechanism of aging in double base propellants. A bibliography is included along with graphic data. Author

N78-25233*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATIONS OF AEROSPACE TECHNOLOGY TO PETROLEUM EXTRACTION AND RESERVOIR ENGINEERING
Leonard D. Jaffe, Lloyd H. Back, C. Martin Berdahl, Earl E. Collins, Jr., Paul G. Gordon, John Houseman, Marshall F. Humphrey, George C. Hsu, John D. Ham, Jack E. Marte et al 30 Oct. 1977 343 p refs
(Contract NAS7-100)
(NASA-CR-157167; JPL-Pub-78-22) Avail: NTIS HC A15/MF A01 CSCL 21D

Through contacts with the petroleum industry, the petroleum service industry, universities and government agencies, important petroleum extraction problems were identified. For each problem, areas of aerospace technology that might aid in its solution were also identified, where possible. Some of the problems were selected for further consideration. Work on these problems led to the formulation of specific concepts as candidate for development. Each concept is addressed to the solution of specific extraction problems and makes use of specific areas of aerospace technology. Author

N78-25234# Los Alamos Scientific Lab., N. Mex.
DETONATION SENSITIVITY TESTS
Manuel J. Urizar, Suzanne W. Peterson, and Louis C. Smith Apr. 1978 41 p refs
(Contract W-7405-eng-36)
(LA-7193-MS) Avail: NTIS HC A03/MF A01

Four detonation tests are described, and the results obtained in applying the tests to a variety of high explosives are presented. In the analysis of the data, emphasis was placed on an examination of the extent to which the tests correlated. It is concluded that the correlation is generally good, but that exceptions are numerous enough that no one test can be used with confidence as a measure of the detonation sensitivity of an explosive over a range of conditions of practical interest. Author

N78-25235*# Gordian Associates, Inc., New York.
COMPUTER MODEL FOR REFINERY OPERATIONS WITH EMPHASIS ON JET FUEL PRODUCTION. VOLUME 3: DETAILED SYSTEMS AND PROGRAMMING DOCUMENTATION Final Report
Daniel N. Dunbar and Barry G. Tunnah 27 Jun. 1978 53 p
(Contract NAS3-20620)
(NASA-CR-135335; Rept-1099-1-Vol-3) Avail: NTIS HC A04/MF A01 CSCL 21D

The FORTRAN computing program predicts flow streams and material, energy, and economic balances of a typical petroleum refinery, with particular emphasis on production of aviation turbine fuels of varying end point and hydrogen content specifications. The program has a provision for shale oil and coal oil in addition to petroleum crudes. A case study feature permits dependent cases to be run for parametric or optimization studies by input of only the variables which are changed from the base case. Author

N78-25236*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CATALYTIC DECOMPOSITION OF METHANOL FOR ONBOARD HYDROGEN GENERATION
Theodore Brabbs Jun. 1978 47 p refs
(NASA-TP-1247; E-9472) Avail: NTIS HC A03/MF A01 CSCL 21D

The steam reformation of an equimolar mixture of methanol and water on a copper chromite catalyst was studied at three furnace temperatures and at feed space velocities from 800 to 2600 per hour. The hydrogen space velocity could be related to the reactor temperature by the equation Sv = A exp (-omega T), where A and omega are constants determined for each value of alpha and T is temperature. At a methanol conversion of 0.87 and a reactor temperature of 589 K, the extrapolated value of the hydrogen space velocity was 9400 per hour. This velocity was used to estimate the size of an onboard hydrogen reactor for automotive applications. Such a reactor would need only about 0.8 liter of catalyst to produce 7630 STP liters (1.5 lb) of hydrogen per hour. This quantity of catalyst would fit into nine tubes 17.8 centimeters along and 2.54 centimeters in inside diameter, which is smaller than most mufflers. The reactor products would contain 12 to 13 percent more chemical energy than the incoming methanol and water. Author

N78-25237*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SURFACTANT-ASSISTED LIQUEFACTION OF PARTICULATE CARBONACEOUS SUBSTANCES Patent Application
George C. Hsu, inventor (to NASA) (JPL) Filed 7 Oct. 1976 20 p
(Contract NAS7-100)
(NASA-Case-NPO-13904-1; US-Patent-Appl-SN-730468) Avail: NTIS HC A02/MF A01 CSCL 21D

Enhanced and improved quality yields are achieved in coal liquefaction by adding to the coal slurry in solvent a small amount of an oil soluble organic surfactant capable of dispersing the asphaltene particles. The liquefaction system described includes a slurrying means having a stirrer in which is formed a slurry of surfactant, particulate coal or other carbonaceous substance and solvent. The slurry is converted in the liquefaction reactor under the influence of heat and high pressure hydrogen to a gaseous hydrocarbon product and to a product slurry which is then separated into a light and heavy oil product, solvent, and coal residue by process steps which include extraction, filtration, and distillation. The effects of surfactant on coal conversion, product distribution, conversion rate and filtration time are demonstrated. NASA

N78-25238# Materials Research Labs., Ascot Vale (Australia).
TEMPERATURES OF ORDNANCE EQUIPMENT EXPOSED AT INNISFAIL, QUEENSLAND
Maureen E. Redman and J. A. McCrae Sep. 1976 151 p
(AD-A053076; MRL-R-672) Avail: NTIS HC A08/MF A01 CSCL 21/9

Temperatures of ordnance material exposed at Innisfail, Queensland, over a period of 18 months have been analysed to determine realistic temperature specifications for design and testing of equipment. The effect of exposure on the chemical deterioration of propellants has been quantified. Author (GRA)

N78-25239# Exxon Research and Engineering Co., Linden, N. J. Government Research Lab.
EVALUATION OF METHODS TO PRODUCE AVIATION TURBINE FUELS FROM SYNTHETIC CRUDE OILS, PHASE 3, VOLUME 3 Final Report, 24 Apr. 1976 - 30 Apr. 1977
William F. Taylor, J. L. Kaufman, E. C. Brown, A. R. Cunningham, and C. A. Smith Jun. 1977 88 p refs
(Contract F33615-74-C-2036; AF Proj. 3048)
(AD-A053106; EXXON/GRU.3PEA.77-Vol-3; AFAPL-TR-75-10-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 21/4

An engineering planning study was made of the effect of processing shale oil in a refinery processing both shale oil and petroleum to a full product slate including jet fuel. This study was part of an overall program whose object was to investigate the feasibility of producing aviation turbine fuels from synthetic crude oils. In this Phase 3 engineering planning study the results and conclusions of the Phase 1 state-of-the-art assessment and Phase 2 pilot plant experimental study were further investigated. The Exxon RESCUE Linear Program for Refinery Planning was used to provide a framework for the analysis. The study which involved a number of arbitrary but well-defined assumptions, was done in the context of a grass roots refinery processing shale oil and petroleum in segregated operations. Shale oil

processing was restricted to distillation and hydrotreating of the kerosene and gas oil fractions, whereas petroleum processing involved a full spectrum of refinery processes with a relatively high level of conversion of heavier fractions to lighter fractions to meet a high motor gasoline demand. GRA

N78-25240# Exxon Research and Engineering Co., Linden, N. J. Government Research Lab.
ALTERNATE FUELS NITROGEN CHEMISTRY Final Technical Report, 19 Oct. 1976 - 20 Oct 1977
John W. Frankenfeld and William F. Taylor Nov. 1977 62 p refs
(Contract N00019-76-C-0675)
(AD-A053299; EXXON/GRUS.1KWC.77) Avail: NTIS HC A04/MF A01 CSCL 21/4

An investigation of the effects of nitrogen compounds on sediment formation was initiated. Several different nitrogen compounds were studied including 2,5-dimethylpyrrole, indole, carbazole and a number of aromatic and aliphatic amines. The diluent employed was purified n-decane. All of the compounds caused darkening of the fuel although appreciable amounts of sediment were formed only with the pyrrole derivatives. The sediment formation was found to be strongly catalyzed by light and by organic acids. Some phenols retarded the sedimentation. A start was made toward characterizing the sediment obtained from 2,5-dimethylpyrrole. It appeared to be a low molecular weight oligomer of partially oxidized pyrrole units. Author (GRA)

N78-25241# California Univ., Livermore. Lawrence Livermore Lab.
ALTERNATIVE FUELS UTILIZATION PROGRAM
C. J. Anderson 7 Dec. 1977 73 p refs
(Contract W-7405-eng-48)
(UCID-17645) Avail: NTIS HC A04/MF A01

The goals, scope, and objectives of the Department of Energy's plan for government participation in alternative fuels research and development are discussed. Because the transportation and transportation energy systems in the U.S. consist mainly of privately-owned companies that provide goods and services to individuals and because the market system is regulated by the government, decision making processes and decisions that link alternative fuels R&D should be responsive to the nation's predominantly private energy system. This plan anticipates the failure of the market to achieve a timely commercialization of alternative fuels for transportation. ERA

N78-25242# American Energy Research Co., Mclean, Va.
SOURCES OF ALCOHOL FUELS FOR VEHICLE FLEET TESTS
W. J. Barr and F. A. Parker 31 Aug. 1977 88 p refs
(Contract EG-77-X-01-2693)
(CONS/2693-1) Avail: NTIS HC A05/MF A01

Twenty-five coal gasification projects were reviewed for the purpose of determining if they offered an opportunity to provide a source of methanol for a fleet vehicle test program. All were concerned with the gasification of coal to produce a low, medium, or high Btu gas or a liquid fuel. The analysis revealed that only four programs offered a reasonable opportunity for completion of a commercial scale gasification plant and full operation in the foreseeable future. Further, all four elected to use the Lurgi gasification technology together with the Lurgi Rectisol gas cleanup process incorporating methanol as the absorbing medium. Consequently all four projects are candidates for supplying the 150 ton needed for a fleet vehicle test program. ERA

N78-25243# Exxon Research and Engineering Co., Linden, N. J. Government Research Labs.
PRODUCTION ECONOMICS FOR HYDROGEN, AMMONIA AND METHANOL DURING THE 1980-2000 PERIOD
H. G. Corneil, Fred J. Heinzelmann, and Edward W. S. Nicholson Apr. 1977 178 p refs Prepared for BNL
(Contracts EY-76-C-02-0016; BNL-368150-S)
(BNL-50663) Avail: NTIS HC A09/MF A01

Refinery hydrogen, ammonia, and methanol, the principal industrial hydrogen products, are now manufactured mainly by catalytic steam reforming of natural gas or some alternative light-hydrocarbon feed stock. Anticipated increases in the prices of hydrocarbons are expected to exceed those for coal, thus gradually increasing the incentive to use coal gasification as a source of industrial hydrogen during the 1980 to 2000 period. Although the investment in industrial hydrogen plants will exceed those for reforming by a factor of 2 or more, coal gasification will provide lower production costs (including 20%/y before tax return) for methanol manufacture in the early 1980's and for ammonia 5 years or so later. However, high costs for transporting coal to major refining centers will make it difficult to justify coal gasification for refinery hydrogen production during the 1980 to 2000 period. ERA

N78-25244# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
HYDROGASIFIER DEVELOPMENT FOR THE HYDRANE PROCESS Quarterly Report, Mar. - May 1977
J. A. Gray and K. M. Sprouse Jun. 1977 116 p refs
(Contract EF-77-C-01-2518)
(FE-2518-4) Avail: NTIS HC A06/MF A01

Short residence, hydropyrolysis of coal experiments in entrained flow reactors are reviewed. Fifty percent carbon conversion was attained with lignite at a temperature of 1600 to 1800 F, a residence time of about 1 second, and a hydrogen pressure of at least 1000 psi; with bituminous coal, 50 percent carbon conversion was attained at 1500 F, a residence time of 0.6 second and a hydrogen pressure of 1000 psi. Small differences in the results (2 to 5 percent carbon conversion) are likely due to variations in the heat up rate and in the conditions of contacting the coal and hydrogen. Product yields are mainly methane and light hydrocarbon liquids with relative amounts of each depending on the temperature. Individual experimental results are reported and certain theoretical results related to scaling laws of chemical reactors used for this purpose are developed. ERA

N78-25245# Energy Research and Development Administration, Washington, D. C.
ALTERNATIVE FUELS DEMONSTRATION PROGRAM, VOLUME 1 OF 2 Final Environmental Impact Statement
Sep. 1977 780 p refs
(ERDA-1547-Vol-1) Avail: NTIS HC A99/MF A01

While processes for converting coal, oil shale and other domestic resources into synthetic fuels have been known for many years, they have not been applied on a commercial scale in the U.S. because, in the past, the synthetic products were not competitive in cost with petroleum and natural gas. In order to remedy this situation, a program to accelerate alternative fuels production was proposed. An environmental statement examines impacts of the program on a plant-by-plant basis and in the aggregate. To examine aggregate impacts, four options for total program implementation were analyzed. The statement deals with the potential environmental impacts that could occur as the result of implementing the Alternative Fuels Demonstration Program under each of these strategies. The statement also uses a building block approach to assess the potential environmental impacts of a synthetic fuels industry, which allows for assessing the impacts related to any combination of production levels, technological mixes, and buildup rates. ERA

N78-25246# California Univ., Berkeley. Lawrence Berkeley Lab.
ELECTRON MICROSCOPY OF HYDROCARBON PRODUCTION IN PARTHENIUM ARGENTATUM (GUAYULE)
Thomas E. Bauer Nov. 1977 190 p refs
(Contract W-7405-eng-48)
(LBL-5688) Avail: NTIS HC A09/MF A01

The biosynthesis of hydrocarbon in the desert shrub Guayule which can produce rubber in concentrations up to one-fourth of its dry weight was studied at the electron microscope level. The biochemistry of rubber formation was used in the selection of melvalonic acid as a tracer. When sufficiently high concentrations of melvalonic acid were administered to seedling Guayule plants, build-ups of metabolized products were found within the chloroplasts of the seedlings. Tritium labeled melvalonic acid was used as a precursor, and its metabolic progress was followed by using the technique of electron microscope autoradiography. These experiments implicated chloroplasts of the Guayule plant in hydrocarbon production. A system to produce three dimensional stereo reconstructions of organelles suspected of involvement in hydrocarbon biosynthesis in Guayule was presented. The

techniques reconstruct an object from serial sections of that object and use stereo imaging both to abstract information for computer processing, and also in the computer produced reconstruction. ERA

N78-25247# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
PILOT STUDIES OF THE BIOCONVERSION OF CELLULOSE AND PRODUCTION OF ETHANOL
Charles R. Wilke 30 Jun. 1977 40 p
(Contract W-7405-eng-48)
(LBL-6860) Avail: NTIS HC A03/MF A01

Progress is reported in the following studies on analysis and evaluation of potential raw materials: preliminary pretreatment studies using wheat straw; extraction of wheat straw with alcohol and water at elevated temperatures; extraction of ground wood with alcohol and water at elevated temperatures; and, delignification of newsprint with ethylene glycol. Other research in progress includes studies on: utilization of hemicellulose sugars; process design and economics of hydrolysis processes and ethanol fermentation; and pilot plant process development and design, including cell-recycle systems for cellulase production, continuous hydrolysis, countercurrent hydrolysis, and ethanol fermentation studies. ERA

N78-25248# Dynatech R/D Co., Cambridge, Mass.
FUEL GAS PRODUCTION FROM ANIMAL WASTE, PHASE 1 Quarterly Progress Report, 1 Jun. - 1 Sep. 1977
E. Ashare, R. L. Wentworth, D. L. Wise, and D. C. Augenstein 28 Sep. 1977 16 p
(Contract EY-76-C-02-2991)
(COO-2991-23; Rept-1665; QPR-4) Avail: NTIS HC A02/MF A01

During this quarter, a quarterly review meeting with ERDA contractors was held. The agenda is included in the appendix. Site visits were made to various ERDA contractors. A preliminary engineering report on digester gas scrubbing was submitted to ERDA. ERA

N78-25249# General Electric Co., Wilmington, Mass. Aircraft Equipment Div.
SPE WATER ELECTROLYSIS TECHNOLOGY DEVELOPMENT FOR LARGE SCALE HYDROGEN PRODUCTION Progress Report, 1 Jan. - 31 Mar. 1977
25 Apr. 1977 42 p
(Contract EY-76-C-02-2675)
(COO-2675-6; PR-6) Avail: NTIS HC A03/MF A01

The following topics are discussed: Low cost current collector development; high temperature operation; catalytic electrode development; low cost polymer development; evaluation of the effect of hydrogen enrichment on older gas pipelines; cell and SPE optimization; cell assembly design; stack assembly design; manufacturing process development; and system analysis and definition. ERA

N78-25250# Institute of Gas Technology, Chicago, Ill.
STATUS OF STEAM-IRON PILOT PLANT OPERATIONS
Paul B. Tarman 1977 12 p Presented at the 9th Syn. Pipeline Gas Symp., Chicago, 31 Oct. - 2 Nov. 1977
(Contract EX-76-C-01-2435)
(CONF-771092) Avail: NTIS HC A02/MF A01

Start-up operations of a pilot plant designed to produce 1.1 million SCF of hydrogen per day began in October 1976. Operations during the first year are summarized. Pilot plant operations were initially directed towards separate startup of the three main systems; the slurry vaporizer, the producer reactor, and the steam-iron reactor. Once these systems were operable on an individual basis, efforts were then concentrated on combined operation of all three systems. Four slurry vaporization tests, six solids circulation tests in the steam-iron reactor, and five char feed and gasification tests were conducted in the producer reactor. The last three tests were directed towards combined operation of the entire system. ERA

N78-25251# Mobil Research and Development Corp., Princeton, N. J.
RESEARCH GUIDANCE STUDIES TO ASSESS GASOLINE FROM COAL BY METHANOL-TO-GASOLINE AND SASOL-TYPE FISCHER-TROPSCH TECHNOLOGIES Monthly Report, Nov. 1977
Max Schreiner Dec. 1977 10 p
(Contract EF-77-C-01-2447)
(FE-2447-12) Avail: NTIS HC A02/MF A01

The results of an economic comparative evaluation of the methanol-to-gasoline and Fischer-Tropsch syntheses are reported. It was concluded that the methanol conversion technology is superior to the F-T technology. The thermal energy loss converting the methanol to gasoline is not excessive. The fluid-bed process is somewhat better than its fixed-bed process. The results of the evaluation are tabulated. Author (ERA)

N78-25252# Natural Dynamics, Des Moines, Iowa.
FAST PRODUCTION OF METHANE BY ANAEROBIC DIGESTION Progress Report, 7 Nov. - 6 Dec. 1977
C. D. Finney, R. S. Evans, II, and K. A. Finney Dec. 1977 32 p
(Contract EY-76-C-02-2900)
(COO-2900-11) Avail: NTIS HC A03/MF A01

Pressure data at 62.5 C were taken for three digesters operating at 50 rpm pulsed to 350 rpm for 15 seconds every five minutes; 50 rpm pulsed to 350 rpm for 45 seconds every five minutes; and 50 rpm pulsed to 350 rpm for 135 seconds every five minutes. Kinetic data in the form of reducing sugars, soluble COD, volatile acids, and methane concentrations for digesters operating at 58.0, 62.5, and 66.0 C are analyzed using first order rate expressions. A table of rate coefficients is presented. ERA

N78-25253# Gordian Associates, Inc., New York.
SMALL REFINER BIAS ANALYSIS Final Report
Jan. 1978 218 p refs
(Contract EM-77-C-01-8758)
(HCP/B70258-01) Avail: NTIS HC A10/MF A01

The small refiner bias program, part of the entitlements program, was intended to help maintain the competitive viability of small and independent refiners. The bias program provides for issuance of additional entitlements to small refiners on a sliding scale basis as a function of company size. The impact of differences in refinery size, refinery type, and type of crude run, by means of engineering and economics analysis of a wide range of possible refinery operations was studied. Estimates were made of refinery investment costs, operating costs, product realizations, and operating margins before and after capital charges. The appropriate government policy toward small and independent refiners is discussed. Author (ERA)

N78-25254# Institute of Gas Technology, Chicago, Ill.
DEVELOPMENT OF THE STEAM-IRON PROCESS FOR HYDROGEN PRODUCTION Quarterly Report, 1 Jan. - 31 Mar. 1977
Nov. 1977 71 p refs Sponsored in part by the Am. Gas Assoc., Inc., Arlington, Va.
(Contract EX-76-C-01-2435; Proj. 9010)
(FE-2435-12; QR-3) Avail: NTIS HC A04/MF A01

Controlled operation of the producer and the steam iron reactor was achieved. A second ore circulation test was completed in the steam iron reactor, and a char feed test was conducted in the producer reactor. Char water slurries, containing solids concentrations up to 30 wt percent solids, were pumped through the slurry heater and vaporized without difficulty for 36 hrs. Some modifications were made in the lift line expansion joint and the 145 degree elbow in the solids transfer line of the steam iron reactor to improve their performance. The objective of Task 4 is to develop improved solids, with high chemical reactivity, high attrition resistance, and no tendency to agglomerate, for use in the steam iron reactor. Fifteen reactivity tests and 10 attrition tests were conducted. The reactivity of iron-chromia 5 was found to be about twice as high as that of siderite. ERA

N78-25255# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
EFFECTS OF ALTERNATE FUELS. REPORT NUMBER 1: ANALYSIS OF HIGH-DUTY FIRECLAY REFRACTORIES EXPOSED TO COAL COMBUSTION
G. C. Wei, V. J. Tennery, and L. A. Harris Dec. 1977 29 p refs

(Contract W-7405-eng-26)
(ORNL-TM-5909; Rept-1) Avail: NTIS HC A03/MF A01

Analyses were performed on high-duty firebrick, fashioned from calcined fireclay and used for the crown of a coalfired periodic kiln that underwent a thermal cycle to 1260 C once a week. The refractory loss of these bricks was approximately 1 in., a rate of approximately 0.07 in./year. A slag formed over the service end or hot face of the brick. The portion of the brick that was not exposed to the slag contained a microstructure of large grog grains interspersed in a fine matrix material. The grog grains consisted of mullite crystallites bonded in a matrix consisting primarily of low cristobalite and glass. Quartz, hematite and rutile were also present in the cold face region of the brick. The principal reactions between the coal slag and this type of highduty refractory brick appear to be (1) original quartz grains in the brick slowly dissolving in the liquid slag formed from fusion of the constituents of the coal ash and (2) mullite crystals present in the brick reacting with the slag. ERA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N78-25256* National Aeronautics and Space Administration. Pasadena Office, Calif.
MULTISTATION REFRIGERATION SYSTEM Patent
Ervin R. Wiebe, inventor (to NASA) (JPL) Issued 7 Mar. 1978 5 p Filed 9 Aug. 1976 Supersedes N77-15219 (15 - 06, p 0733) Sponsored by NASA
(NASA-Case-NPO-13839-1; US-Patent-4,077,231; US-Patent-Appl-SN-712981; US-Patent-Class-62-514R; US-Patent-Class-250-332; US-Patent-Class-313-22) Avail: US Patent Office CSCL 13A

A closed cycle refrigeration (CCR) system is disclosed for providing cooling at different parts of a maser. The CCR includes a first station for cooling the maser's parts, except the amplifier portion, to 4.5 K. The CCR further includes means with a 3.0 K station for cooling the maser's amplifier to 3.0 K and, thereby, increases the maser's gain and/or bandwith by a significant factor. The means which provide the 3.0 K cooling include a pressure regulator, heat exchangers, an expansion valve, and a vacuum pump, which coact to cause helium, provided from a compressor, to liquefy and thereafter expand so as to vaporize. The heat of vaporization for the helium is provided by the maser amplifier, which is thereby cooled to 3.0 K.
Official Gazette of the U.S. Patent Office

N78-25257*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AUTOMATED MIXED TRAFFIC VEHICLE (AMTV) TECHNOLOGY AND SAFETY STUDY Final Report, Sep. 1977 - Feb. 1978
Alan R. Johnston, Ted K. C. Peng, Howard C. Vivian, and Peter K. Wang Feb. 1978 126 p refs Sponsored by DOT
(NASA-CR-157171; JPL-Pub-78-12; UMTA-CA-06-0088-78-1) Avail: NTIS HC A07/MF A01 CSCL 13F

Technology and safety related to the implementation of an Automated Mixed Traffic Vehicle (AMTV) system are discussed. System concepts and technology status were reviewed and areas where further development is needed are identified. Failure and hazard modes were also analyzed and methods for prevention were suggested. The results presented are intended as a guide for further efforts in AMTV system design and technology development for both near term and long term applications. The AMTV systems discussed include a low speed system, and a hybrid system consisting of low speed sections and high speed sections operating in a semi-guideway. The safety analysis identified hazards that may arise in a properly functioning AMTV system, as well as hardware failure modes. Safety related failure modes were emphasized. A risk assessment was performed in order to create a priority order and significant hazards and failure modes were summarized. Corrective measures were proposed for each hazard. Author

N78-25258# Arkansas Univ., Fayetteville. College of Engineering.
WATER CONSERVATION IN INDUSTRIAL FILTRATION OPERATIONS
L. Turpin 30 Sep. 1977 58 p refs
(PB-277356; W78-03932) Avail: NTIS HC A04/MF A01 CSCL 13H

The washing of a solute from filter cakes was investigated for both saturated and unsaturated washing conditions. Systems used in this experimental study were 0.065 NaCl solution as the filtrate in an aluminum hydrate filter cake and 0.1 Normal HCl solution as the filtrate in a column packed with glass beads. The filtrate concentration as a function of the flow rate of wash water and of the volume of effluent from the pack bed was measured. The amounts of filtrate removed from the bed during saturated washing and washing employing repetitive steps of saturation followed by evacuation were compared. Also, the amounts of wash water required to lower the filtrate concentration to essentially zero were contrasted. The saturated wash condition was more efficient in removing the filtrate from compressible cakes, while the reverse was true for porous, incompressible cakes. Computer programs were developed to simulate both saturated and unsaturated washing conditions. GRA

N78-25259# Civil and Environmental Engineering Development Office, Tyndall AFB, Fla.
HARDWALL EXPANDABLE SHELTER Final Report, Apr. 1973 - Aug. 1977
Joseph P. Sugg Sep. 1977 60 p
(AF Proj. 2054)
(AD-A053008; CEEDO-TR-77-45) Avail: NTIS HC A04/MF A01 CSCL 13/13

The Air Force awarded a contract to Brunswick Corporation for the development of a basic rigid/expandable shelter that would fulfill various user requirements with little or no change in shelter design. Furthermore, the shelter was to be compatible with both air and surface transport criteria. Extensive testing verified that the shelter meets these two basic criteria. However, design details need revision to improve watertightness and reduce shelter gross weight. The Air Force should adopt the hardwall expandable shelter (HES) as a standard for meeting future tactical shelter requirements. Author (GRA)

N78-25260# Army Construction Engineering Research Lab., Champaign, Ill.
TRENDS IN THE REAL PRICES OF SELECTED CONSTRUCTION PRODUCTS AND MATERIALS, 1946 - 1976
R. Ramsson Mar. 1978 37 p
(AD-A053228; CERL-SR-D-84) Avail: NTIS HC A03/MF A01 CSCL 13/3

This study measured trends in the relative prices of 13 construction goods and materials from 1946 through 1976. The prices of three of these products--Douglas Fir lumber, structural steel products, and steel reinforcing bars--have increased substantially since World War II. The prices of plywood, building paper and board, heating equipment, asphalt, and gypsum products have declined during the Post-War period. The prices of the remaining products--Southern Pine lumber, concrete products, millwork, plumbing fixtures and brass fittings, and structural clay products--have shown little or no change. The pattern of the real prices of these products in 1976 suggests that savings in construction materials can be obtained by substituting for those products whose prices have increased. Author (GRA)

N78-25261# National Materials Advisory Board, Washington, D. C.
SKIRTS AND SEALS FOR SURFACE EFFECT VEHICLES Final Report
Apr. 1978 120 p refs
(Contract MDA903-78-C-0038)
(AD-A053338; NMAB-340) Avail: NTIS HC A06/MF A01 CSCL 13/10

Surface Effect Vehicles (SEV's) with weights up to 200 tons capable of speeds up to 80 knots over water and land are in service. Considerably larger vehicles are under development. However, the life of the fabric-reinforced, elastomer-coated skirt/seal systems on current vehicles is short; it is anticipated that even shorter skirt lives will be encountered on the larger,

higher speed vehicles under development, limiting the military potential and commercial practicality of the SEV mode of transportation. The skirts are subjected to a salt water, sand, marsh, or ice environment coupled with the dynamic loading induced by high speed operation. Their failure is a very complex, interdisciplinary problem that is not completely understood. Three major modes of failure are evident: delamination; abrasion; and tearing. These may occur separately or in combination, depending on: vehicle size and design; vehicle mission; skirt and seal design; and skirt and seal material. The current status of the development of skirts and seals is reviewed. Modes of failure, loading conditions, and effects of environments, materials selection, methods of manufacture, system fabrication, and test methods are discussed. A series of recommendations is made that, if followed, should lead to the development of more durable skirts and seals. GRA

N78-25262# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.

UNSTEADY CAVITATION ON AN OSCILLATING HYDROFOIL

Young T. Shen and Frank B. Peterson Jan. 1978 41 p refs (AD-A052884; Rept-78-SPD-809-01) Avail: NTIS HC A03/MF A01 CSCL 20/4

Bent trailing edges and erosion, which are often observed on marine propellers, are attributed mainly to unsteady cavitation caused by the nonuniformity of flow field behind ship's hull. In order to improve the physical understanding, the formation of cloud cavitation and bubble collapse on marine propellers, a two-dimensional hydrofoil was tested at the DTNSRDC 36-inch water tunnel under pitching oscillation. The inception of cavitation, cavity growth, and collapse were investigated in terms of the reduced frequency. The possible cause of 'cloud cavitation' and the applicability of a quasi-steady method to predict unsteady cavitation were investigated and discussed. Author (GRA)

N78-25263# Army Construction Engineering Research Lab., Champaign, Ill. Materials and Science Div.

FEASIBILITY OF STRUCTURAL FOAM/CONCRETE BUILDING FOR THEATER OF OPERATIONS USE Final Report

Alvin Smith Mar. 1978 26 p refs (DA Proj. 4A7-62719-AT-41) (AD-A053272; CERL-TR-M-231) Avail: NTIS HC A03/MF A01 CSCL 13/3

This study was performed to assess the feasibility of using performed polystyrene foam building blocks to construct shelters in noncombative areas of the Theater of Operations (TO). A structure in which the principal wall material was polystyrene foam blocks was designed, constructed, and evaluated on the basis of logistics requirements, manpower time, required skill levels, and costs. It was concluded that the polystyrene foam block building required less than half the man-hours and slightly lower skill levels than were necessary to erect a similar-sized Army Facilities Components System timber building. However, the foam block building has a 75 percent greater shipping volume in the expanded form, and a 300 percent greater materials cost. Based on the conclusions, it is recommended that the foam block system be used in the TO only if the expansion and molding equipment is established within the area of planned usage. Author (GRA)

N78-25264# Addis Translations International, Portola Valley, Calif.

METHOD FOR CLEANING SURFACES BY CHEMICAL ICE BLASTING

T. Kawamoto Nov. 1977 9 p Transl. into ENGLISH from patent no. 97533-1975 (Japan), 2 Aug. 1975 9 p Prepared for Battelle Pacific Northwest Labs. Sponsored by DoE (BNWL-tr-278) Avail: NTIS HC A02/MF A01

A method is described for cleaning surfaces by chemical ice blasting. A cleaning agent is used which consists of countless tiny bits of ice to which one or more of the following was added in an amount equivalent to 5-50 percent weight: sodium phosphate, potassium phosphate, and ammonium phosphate. Author (ERA)

N78-25265# Brookhaven National Lab., Upton, N. Y.

POLYMER CONCRETE PATCHING MATERIALS

Jack J. Fontana Sep. 1977 14 p refs Presented at the Fall Conv. of the Am. Concrete Inst., New Orleans, 16 Oct. 1977 (Contract EY-76-C-02-0016) (BNL-23369; Conf-771079-1) Avail: NTIS HC A02/MF A01

The increase use of deicing salts is causing rapid deterioration of portland cement concrete bridge decks. Soluble chlorides cause corrosion of the steel reinforcing rods with a corresponding increase in volume of the rods. This expansion causes stresses in the concrete which result in delaminations and surface spalling. The repair of surface spalls with portland cement concrete can only be made if traffic can be avoided for several days. A patching material which would allow traffic to resume over the repaired area in a few hours was needed. Polymer concrete (PC) was developed to repair deteriorated portland cement concrete. Polymer concrete is defined as a composite material in which the aggregate is bound together in a dense matrix with a polymer binder. The aggregate is mixed with a monomer mixture and subsequently cured in place. Polymer concrete combines the premix characteristics of portland cement concrete with high strength, long term durability properties and fast cure times. PC placed at temperatures between 35 F and 95 F attains strengths greater than 5000 psi in 2 hours. ERA

N78-25266# Argonne National Lab., Ill.

VAPOR-EXPLOSION EXPERIMENTS WITH SUBCOOLED FREON

R. E. Henry and L. M. McUmber Jun. 1977 32 p refs (Contract W-31-109-eng-38) (ANL-77-43) Avail: NTIS HC A03/MF A01

Vapor explosion experiments were conducted in a well wetted Freon 22 and mineral oil system in which the initial temperature of both the Freon and the mineral oil were varied over a wide range. These experiments were specifically conducted to investigate the importance of interface temperature in determining the explosive behavior of a given system. The results clearly demonstrate that the interface temperature developed upon intimate liquid-liquid contact is a valid characterization of the explosive potential of a given system. ERA

N78-25267# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.

CONCRETE POLYMER MATERIALS, PRODUCTION METHODS AND APPLICATIONS

Lawrence E. Kukacka Oct. 1977 10 p refs Presented at World of Concrete Symp., Polymers in Concrete, Phoenix, Ariz., 13 Jan. 1978 (Contract EY-76-C-02-0016) (BNL-23497; Conf-780102-1) Avail: NTIS HC A02/MF A01

Methods for producing two materials, polymer impregnated concrete and polymer concrete, are discussed and their structural and durability properties summarized. Existing and potential applications for these materials such as for chemical storage tanks, pilings, pipe, curbstones, and bridge decks are reviewed. ERA

N78-25268# Oak Ridge National Lab., Tenn.

DOCUMENTATION OF THE ENGINEERING PROPERTIES OF CESIUM AND POTASSIUM

R. L. Graves 19 Oct. 1977 65 p refs (Contract W-7405-eng-26) (ORNL-5344) Avail: NTIS HC A04/MF A01

A set of engineering properties of cesium and potassium is documented for use in the alkali metal topping cycle study. The thermodynamic properties, necessary for the general cycle calculation, were obtained. The transport properties of cesium and potassium, which were documented by selecting the recommended data of various investigators, were valuable in heat transfer and fluid flow considerations. Preliminary analysis of the topping cycle turbine also required knowledge of the vapor sonic velocity. Values for frozen and equilibrium sonic velocity were calculated and reported. ERA

N78-25269# National Technical Information Service, Springfield, Va.

CONSTRUCTION MANAGEMENT. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Mar. 1978

George W. Reimherr Apr. 1978 274 p Supersedes NTIS/PS-77/0291; NTIS/PS-76/0297; NTIS/PS-75/352 and COM-73-11798
(NTIS/PS-78/0319; NTIS/PS-77/0291; NTIS/PS-76/0297; NTIS/PS-75/352; COM-73-11798) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

The bibliography cites management studies on the physical, social, and environmental factors of the construction industry. Cost and design studies are included for military and civilian construction of buildings, houses, mobile homes, tunnel excavations, and roads. To aid the manger in planning and control, construction codes, data management, and contract administration research are also cited. GRA

N78-25270# National Technical Information Service, Springfield, Va.
METRICATION IN THE UNITED STATES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Mar. 1978
Guy E. Habercom, Jr. Apr. 1978 167 p Supersedes NTIS/PS-77/0268; NTIS/PS-76/0305 and NTIS/PS-75/123
(NTIS/PS-78/0316; NTIS/PS-77/0268; NTIS/PS-76/0305; NTIS/PS-75/123) Avail: NTIS HC $28.00/MF $28.00 CSCL 14B

Materials are cited on the metric system of measurements and conversion of U. S. measurements to the metric system. The reports deal with the metrication process, industrial and economic impacts, problems involved, the benefits anticipated, and public reactions and relations. The metric system is dicussed, along with its application to various fields. GRA

N78-25271# National Bureau of Standards, Washington, D. C.
REPORT TO AID ON NBS/AID WORKSHOP ON STANDARDIZATION AND MEASUREMENT SERVICES Final Report
H. Steffen Peiser, ed., Charles C. Raley, ed., and Cathy A. Schroyer, ed. Dec. 1977 113 p ref Workshop held at NBS, Gaithersburg, Md., 16-30 Oct. 1976 Sponsored in part by AID
(Grant PASA-TA(CE)-6-71)
(PB-277984/1; NBSIR-77-1385) Avail: NTIS HC A06/MF A01 CSCL 14B

The object of the workshop was to give standard officials of industrializing nations insight into the standards and measurement systems of the United States and the role of the National Bureau of Standards, so that these officials might consider what parts of the U.S. system might usefully be adapted to conditions in their home countries. An exchange of standardizations experience in each of the participant's countries was presented. Countries represented included Afghanistan, Bangladesh, Bolivia, Ecuador, Ghana, Guyana, India, Indonesia, Iran, Jordan, Kenya, Korea, Nigeria, and Yemen. GRA

N78-25272# National Bureau of Standards, Washington, D. C.
METRIC DIMENSIONAL COORDINATION: THE ISSUES AND PRECEDENT Final Report
Sandra A. Berry and Hans J. Milton Feb. 1978 79 p refs Proc. of joint Conf. of the Design Sector and Construc. Prod. Sector of the Construc. Ind. Coordinating Comm. of the Am. Natl. Metric Council, Washington, D. C., 6 Jun. 1977
(PB-277676/3; NBS-SP-504) Avail: NTIS HC A05/MF A01 CSCL 13M

The papers presented at the conference address the following topics: (1) dimensional coordination - an industrial management tool, which reviews the issues and application of dimensional coordination; (2) building standards development in Sweden and in the metric building world, which outlines issues in national and international standardization in the context of building design, production and construction dimensions; and, (3) metrication - the opportunity for an industry-wide system of dimensional coordination - precedents and issues, which reviews precedent in metrication and the simultaneous change to preferred building dimensions and preferred sizes in component production. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N78-25273*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
DESIGN AND FABRICATION OF MICROSTRIP ANTENNA ARRAYS Final Report, 1 Jun. 1975 - 30 Jun. 1978
Jun. 1978 154 p refs
(Grant NsG-1142)
(NASA-CR-157041) Avail: NTIS HC A08/MF A01 CSCL 17B

A microstrip array project was conducted to demonstrate the feasibility of designing and fabricating simple, low cost, low sidelobe phased arrays with circular disk microstrip radiating elements. Design data were presented for microstrip elements and arrays including the effects of the protective covers, the mutual interaction between elements, and stripline feed network design. Low cost multilayer laminate fabrication techniques were also investigated. Utilizing this design data two C-band low sidelobe arrays were fabricated and tested: an eight-element linear and a sixty-four element planar array. These arrays incorporated stripline Butler matrix feed networks to produce a low sidelobe broadside beam. Author

N78-25274*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SECURE COMMUNICATION SYSTEM Patent Application
George D. Doland, inventor (to NASA) (Lockheed Electronics Co., Inc., Houston, Tex.) Filed 28 Apr. 1978 21 p Sponsored by NASA
(NASA-Case-MSC-16462-1; US-Patent-Appl-SN-900841) Avail: NTIS HC A02/MF A01 CSCL 17B

A product code, formed from the pseudorandom sequences of digital bits, is used to encipher, or scramble, data prior to transmission. The two pseudorandom sequences (one of which is transmitted continuously with the scrambled data for synchronization) are changed before they have had time to repeat. The communication system comprises a master timer, a message encoder/transmitter, and a message decoder/receiver, and employs an electronically randomized variant of quadraphase modulation and demodulation between two synchronized transcievers. Messages are encoded by using the combined outputs of two pseudo-random-sequence generators which are 41 stage shift register devices. NASA

N78-25275*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SATELLITE PERSONAL COMMUNICATIONS SYSTEM Patent Application
Norman B. Reilly (JPL) and Joel G. Smith, inventors (to NASA) (JPL) Filed 30 May 1978 23 p
(Contract NAS7-100)
(NASA-Case-NPO-14480-1; US-Patent-Appl-SN-910707) Avail: NTIS HC A02/MF A01 CSCL 17B

A mobile communication system was designed that can be utilized to reliably interconnect large numbers of dispersed mobile units over a wide area such as the continental United States. The system includes a geostationary satellite with a large diameter reflector antenna, with a matrix of feed horns, for transmitting narrow beams that each cover a specific limited area or sector of the United States. The feed horn matrix also enables the detection of the specific sector from which a transmission is received. This permits the satellite to detect the particular sectors in which a caller and called party are located, and to retransmit signals between them, utilizing narrow beams that do not cover other sectors of the country. Thus, the same frequency band can be utilized in each of many different sectors of the United States utilizing only a moderate band width of the radio frequency spectrum. NASA

N78-25276# Communications Research Centre, Ottawa (Ontario). Space Applications Branch.

APPLICATION OF FORWARD ERROR CORRECTION OVER AERONAUTICAL SATELLITE DATA LINKS

R. Lyons (Miller Commun. Systems Ltd., Kanata, Ontario) and L. Beaudet (Miller Commun. Systems Ltd., Kanata, Ontario) Apr. 1978 36 p refs

(CRC-1314) Avail: NTIS HC A03/MF A01

A survey is made of forward error correction codes which were developed to correct burst errors. These codes were examined for their suitability in the Aerosat channel which produces a combination of random and burst errors. The constraints imposed by the Aerosat channel and the impact of FEC are discussed. Finally an implementation of a rate 1/2 diffuse convolutional codes, which is well suited to the Aerosat channel, is described. Author

N78-25277# European Space Agency, Paris (France).

ADVANCED SATELLITE COMMUNICATIONS SYSTEMS USING THE 20 TO 30 GHz BANDS

G. Berretta, ed., B. Battrick, ed., and S. Vermeer, ed. Jan. 1978 279 p refs Partly in ENGLISH and partly in FRENCH; ENGLISH summaries Proc. of Symp. held at Genoa, 14-16 Dec. 1977; co-sponsored by CNR

(ESA-SP-138) Avail: NTIS HC A13/MF A01

Papers, by European, American and Japanese authors, are discussed. They cover both the system and technology aspects of using the 20/30 GHz bands for satellite communications. Economic viability is considered and the application of such new techniques as satellite switched TDMA, on-board regeneration and adaptive downlink power sharing is proposed. The state-of-the-art in terms of components, radio equipment and antennas is reported and the effect of rain on 20/30 GHz links considered. In addition, a report on the round-table discussions that followed the symposium presentations is included. For individual titles, see N78-25278 through N78-25306.

N78-25278# Politecnico di Milano (Italy). Centro Telecomunicazioni Spaziali.

APPLICATION OF THE 20 TO 30 GHz BAND TO SATELLITE COMMUNICATION SYSTEMS

F. Carassa *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p xi-xiii refs (For availability see N78-25277 16-32)

Avail: NTIS HC A13/MF A01

Frequency bands available for satellite communications between 10 and 30 GHz are presented. Maximum efficiency in terms of services rendered to the user community, areas services and point to point service between predetermined high traffic terminals is required. ESA

N78-25279# National Space Development Agency, Tokyo (Japan).

EXPERIMENT PROGRAMME FOR THE JAPANESE COMMUNICATIONS SATELLITE

Masaichi Hirai and Hiroshi Uda *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 1-15 (For availability see N78-25277 16-32)

Avail: NTIS HC A13/MF A01

The mission objectives, progress of the program, characteristics of spacecraft, launch sequence and earth stations, and planned experiment of the Japanese medium-capacity communications satellite for experimental purpose (CS) are described. This satellite has two C-band (6/4 GHz), six K-band (30/20 GHz) communication transponders and a high-gain shaped-beam despun antenna. The bandwidth of each channel is about 200 MHz. The CS will be launched by a U.S. Delta 2914 launch vehicle in middle of December, 1977, and located at 135 E longitude in a geostationary orbit. The ground system consists of three fixed and several transportable stations and associated facilities. Particular attention is paid to the experiments and development of quasi-millimeter wave communication systems via this satellite for foreseen needs. Author (ESA)

N78-25280# Telespazio, S.p.A., Rome (Italy). Telecommunications Dept.

POINT-TO-POINT SATELLITE SYSTEMS AT 20/30 GHz

S. Tirro *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 17-33 refs (For availability see N78-25277 16-32)

Avail: NTIS HC A13/MF A01

The use of 20/30 GHz band is very promising for implementing point-to-point satellite circuits competitive with equivalent terrestrial circuits. New techniques, such as multibeam satellite antennas, SS-TDMA and space diversity, need to be developed. As concerns Europe, traffic requirements such to justify the use of 20/30 GHz bands will exist at the end of the 80s, and an experimental program in the early 80s is considered necessary. Author (ESA)

N78-25281# European Broadcasting Union, Brussels (Belgium).

UP-LINES FOR BROADCASTING SATELLITES

Alan Brown *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 35-42 (For availability see N78-25277 16-32)

Avail: NTIS HC A13/MF A01

The European Broadcasting Union's interest in the use of the 30 GHz band for up-links to broadcasting satellites is emphasized. The possibility of having very narrow beam widths on the satellite receiving antennas may permit the total bandwidth needed for the up-links to be below 800 MHz. The earth-station transmitting antenna could be small, and this could have operational advantages. A tentative link budget is given. Author (ESA)

N78-25282# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.

ADAPTIVE CONTROL OF SATELLITE RESOURCES

J. Arnbak *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 43-49 refs (For availability see N78-25277 16-32)

Avail: NTIS HC A13/MF A01

The deep fades in a satellite communications network employing the 20-30 GHz bands may be overcome by adapting the satellite resources to the dynamic environment. In such a concept, all links contribute to a mutual insurance scheme by surrendering part of their clear-weather link margins when necessary to support individual links threatened by outage. The merits of exercising network resource control by satellite processing, rather than at each accessing earth terminal, are explored. Multibeam antennas and multimode transponders are candidate control elements in the generic approaches discussed. Significant advantages of satellite-processed control concepts appear to be improved link availability without site diversity arrangements, viability of standardized, low-cost terminals, and achievement of small loop delays in a central control scheme. Author (ESA)

N78-25283# European Space Research and Technology Center, Noordwijk (Netherlands).

ON-BOARD REGENERATION IN A SATELLITE COMMUNICATIONS SYSTEM OPERATING AT 30/20 GHz

F. Fiorica and R. Stengel *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 51-59 refs Prepared jointly with Centro Studi e Lab. Telecomun. (For availability see N78-25277 16-32)

Avail: NTIS HC A13/MF A01

Use of SS-TDMA can solve the fundamental power limitation problem at 30/20 GHz. The high traffic capacity achievable in these bands will be thoroughly exploited, by means of a large number of ground stations, if the cost of the individual station can be kept low. It is shown how on-board regeneration achieves such a goal by reducing power requirements and the complexity of the SS-TDMA terminal, while entailing also advantages in the satellite hardware. In addition, a few possibilities are open, by use of on-board regeneration, which are not conceivable with conventional repeaters. In the case that one satellite repeater can be dedicated to each station, a more favourable rearrangement of the information data is possible than in SS-TDMA, which leads to eliminate burst operation in both the down and the up-link, while retaining full interconnectivity. Both with such a new technique and with SS-TDMA, regenerative or not, system resources can be spared by dedicating a few satellite repeaters to fixed links among the main traffic sources. Author (ESA)

N78-25284# European Space Research and Technology Center, Noordwijk (Netherlands).

DESIGN CONSIDERATIONS FOR ANTENNAS FOR THE

MILLIMETER WAVE BANDS
J. Aasted *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 61-65 (For availability see N78-25277 16-32)
Avail: NTIS HC A13/MF A01

The use of the 20/30 GHz band for satellite communication will allow much more freedom in antenna design than has been possible at the lower frequencies. They can be electrically larger even if they are identical mechanically to lower frequency units. This freedom can be used to produce antennas with multiple beams, with contoured beams, and even with multiple, contoured and switchable beams with the associated added freedom in systems design. It will make possible such concepts as 'switch-board-in-the-sky' and on-board regenerative systems. To utilize this added degree of freedom will require development of several new technologies. Author (ESA)

N78-25285# Naples Univ. (Italy). Ist. Elettrotecnico.
STUDIES ON SATELLITE COMMUNICATION ANTENNAS AT UNIVERSITY OF NAPLES
G. Franceschetti *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 67-74 refs (For availability see N78-25277 16-32)
Avail: NTIS HC A13/MF A01

Studies being carried out at the Department of Electrical Engineering, University of Naples, Italy, in the field of satellite communication antennas under several sponsorships are summarized. They include topics in the design of multi-beam reflector antennas, high performance antennas, feed radiation prediction and near-field/far-field techniques. In particular, a proper definition of phase center of a primary feed system is presented, which optimizes the radiation pattern of the secondary radiator; the effect of reflector rim loading on lobe intensity and polarization purity is studied; an alternative formulation of radiation for primary feeds is presented; a new near-field/far-field expansion technique is suggested, based on hyperspheroidal functions representation. Author (ESA)

N78-25286*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NEW APPROACHES TO ANALYSIS AND SYNTHESIS OF REFLECTOR ANTENNAS
Victor Galindo-Israel and Raj Mittra *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 75-79 refs (For availability see N78-25277 16-32)
(Contract NAS-7-100)
Avail: NTIS HC A13/MF A01 CSCL 17I

Recently developed techniques are reviewed for analyzing and synthesizing single and dual antennas for high efficiency and wide angle scan. The problem of contour beam synthesis using superposition of pencil beams is also discussed. Author (ESA)

N78-25287# Centre National d'Etudes Spatiales, Toulouse (France).
REFLECTOR AND MULTIBEAM ANTENNAS. COMPUTER PROGRAMS AND EXPERIMENTAL STUDIES [ANTENNES A REFLECTEURS ET MULTISOURCES. MOYENS INFORMATIQUE D'ETUDE ET EXEMPLES DE REALISATIONS]
B. Curbelie, J. Bernard, and Vidal Saint-Andre *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 81-89 refs In FRENCH; ENGLISH summary Prepared jointly with Thomson-CSF, Paris (For availability see N78-25277 16-32)
Avail: NTIS HC A13/MF A01

Advantages and drawbacks of array-fed reflector antennas for communication satellites are reminded; computer programs which provide fast, efficient means to design and test this reflector antenna category are presented. Three experimental studies, in L-band, in C-band and in X-band, are described for each of them, main electrical and geometrical characteristics, are given. Significant results and some predictions by means of preceding programs are given. Author (ESA)

N78-25288# Ticra A/S, Lyngby (Denmark).
ANALYSIS OF FEED ELEMENTS FOR MULTIBEAM ANTENNAS USING THE METHOD OF MOMENTS AND SPHERICAL-WAVE TECHNIQUES
P. Balling *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 91-95 refs (For availability see N78-25277 16-32)
(Contract ESTEC-2892/76-NL-AK)
Avail: NTIS HC A13/MF A01

Two approaches are presented for calculating the radiation from rotational symmetric feed elements protruding from an infinite ground plane. In one method a calculation is carried out by means of an existing, general-purpose method-of-moments program for a finite circular flange and the flange effects are then removed by ray-optical considerations. In the other method a system of coupled integral equations are set up to allow analysis of dielectric loaded feed elements to be carried out. Author (ESA)

N78-25289# Naples Univ. (Italy). Ist. Elettrotecnico.
PROBLEMS IN THE DESIGN OF MULTIBEAM ANTENNAS
G. diMassa, R. Pierri, and F. Sollazzo *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 97-103 refs (For availability see N78-25277 16-32)
Avail: NTIS HC A13/MF A01

The design of a multi-beam antenna for a domestic satellite point-to-point communication system is outlined. As an example, the case of an Italian satellite is considered in detail. The problem of the phase center is also considered, suggesting a new most general definition. For feeds applications, this definition is connected with the optimization of the reflector radiation diagram. Author (ESA)

N78-25290# Electrical Research Association, Leatherhead (England).
OFFSET-REFLECTOR SPACECRAFT ANTENNAS: DESIGN AND EVALUATION AT 30 GHz
A. W. Rudge and N. Williams *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 105-114 refs (For availability see N78-25277 16-32)
Avail: NTIS HC A13/MF A01

An investigation of the performance and the limitations of multiple-beam antennas employing offset parabolic reflectors and multiple-element primary-feeds is presented. A design and optimization procedure is described which includes cost effective computer modelling techniques to provide accurate predictions of the antenna co- and cross-polar radiation characteristics. The procedure is applied to generate the optimized design of a multiple-beam antenna satisfying a given ESA specification. Validation of the theory is provided with the construction and evaluation of a precision electrical breadboard model operating about a center frequency of 30 GHz. Author (ESA)

N78-25291# Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
SOME ASPECTS OF SATELLITE COMMUNICATIONS ANTENNAS FOR 20 AND 30 GHz FREQUENCY BANDS
S. DePadova, P. Ferrazzoli, and G. Pellegrineschi *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 115-126 refs Prepared jointly with Telespazio and Consorzio per Sistemi di Telecomun. via Satelliti (For availability see N78-25277 16-32)
Avail: NTIS HC A13/MF A01

The introduction of new satellite communication systems operating at 20 and 30 GHz frequency bands will require advances in nearly every satellite subsystem of space and ground segments. The main factors affecting the electrical performances of different antenna types, without claiming to indicate optimal solutions are surveyed. Topics such as structural problems, main earth antennas radioelectric aspects, and multibeam satellite antennas are dealt with. Author (ESA)

N78-25292# Ford Aerospace and Communications Corp., Palo Alto, Calif.
TRANSPONDER AND ANTENNA-DESIGN PROBLEMS AT MILLIMETER WAVELENGTHS FOR 20-30 GHz COMMUNICATIONS SATELLITES
C. L. Cuccia, R. Hoffman, H. Voris, and R. Tyler *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 127-136 refs (For availability see N78-25277 16-32)
Avail: NTIS HC A13/MF A01

The Japanese medium capacity Communication Satellite (CS)

includes two C-band transponder channels in the 4-6 GHz range, and six K-band transponder channels in the 18-30 GHz range. Each of these channels is 200 MHz wide and the design of these channels was specifically directed toward optimal transmission of 100 Mbps BPSK digital carriers. This satellite is a spinner satellite using a bus derived from the NATO satellite. The difficulties encountered in providing the actual hardware realization of this satellite due to extreme problems related to mechanical assembly and tolerance and to antenna pattern, channel bandwidth, and loss/power sensitivity which are not encountered at much lower frequencies of 4/6 GHz and 11/14 GHz but which are indigenous to the millimeter wave frequencies of 20 and 30 GHz are emphasized. The problems in packaging and integration of the 20-30 GHz portion of the transponder and the 18-28 GHz portion of the antenna feed involving shortest length and therefore lowest loss connections in extremely confined spaces, within the satellite structure are discussed. Author (ESA)

N78-25293# European Space Research and Technology Center, Noordwijk (Netherlands).
THE MILLIMETER WAVE COMMUNICATIONS TRANSPONDER FOR THE H-SAT EXPERIMENT
M. Lopriore and G. Perrota *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 137-146 refs Prepared jointly with Selenia (For availability see N78-25277 16-32)
Avail: NTIS HC A13/MF A01

The European Space Agency has recently completed the definition studies of the payloads considered for the Heavy Satellite (H-Sat) program. These payloads are: a television broadcasting payload operating in the 11-14 band; a millimeter wave propagation experiment using 20 and 30 GHz beacons; and a millimeter wave payload for communication experiments. The purposes of the Millimeter Wave Communication Experiment (MWCE), the system concept from which the selected configuration was derived, and the key features of the transponder considered for flying on H-Sat are described. Author (ESA)

N78-25294# Compagnia Generale di Elettricita S.p.A., Milan (Italy).
THE PROSPECTIVE H-SAT MILLIMETRE WAVE CARRIER GENERATOR
M. Ronsisvalle *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 147-154 (For availability see N78-25277 16-32)
Avail: NTIS HC A13/MF A01

The carrier generator proposed configuration is at first described, according to which the output signals are obtained by multiplying five S band generated frequencies. The latter are provided by some phase locked sources to a centralized master oscillator. After a preliminary comparison to the fundamental synthesis approach, the basic items are described in detail and their arising from OTS and ECS space programs is pointed out. The carrier generator expected performances are afterwards reported, which are based on the presently available preliminary results. Author (ESA)

N78-25295# Istituto di Elettronica e Telecomunicazioni, Turin (Italy).
DESIGN GUIDELINES FOR A SATELLITE REGENERATIVE REPEATER
V. Castellani, M. Pent, F. Pattini, and P. PorzioGiusto *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 155-164 refs Sponsored by ESA Prepared jointly with Centro Studi e Lab. Telecomun. (For availability see N78-25277 16-32)
Avail: NTIS HC A13/MF A01

A satellite digital link with on-board regeneration is considered and compared with conventional non-regenerative digital links. The system tradeoffs are presented and the advantages of on-board regeneration are emphasized. A differential phase modulation is proposed for the up-link and a conventional CPSK for the down-link. The performance of on-board demodulation is studied in detail both for the achievable error rates and for the behavior and impairments of the bit timing recovery circuits in a burst transmission environment. Extensive numerical results are presented. The hardware implementation problems are also analyzed in detail; design guidelines are discussed both for the on-board receiver and transmitter. Author (ESA)

N78-25296# AEG-Telefunken, Ulm (West Germany).
DESIGN CONSIDERATIONS, DESIGN LIMITS AND INTERFACE PROBLEMS FOR HIGH FREQUENCY SATELLITE TWT'S
D. Deml *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 167-173 (For availability see N78-25277 16-32)
Avail: NTIS HC A13/MF A01

Designing satellite tubes for 20, 30, and 60 GHz cannot be done by simply scaling from available 12 GHz/20 W tubes. Cathode loading, magnetic field and the minimum beam diameter which can be realized taking thermal and mechanical properties of the helix into account have to be carefully investigated. A compromise of these three main parameters leads finally to the tube design parameters. As a result we find that with helix tube voltages between 4 and 6 kV an output power of 30 W at 20 GHz, 20 W at 30 GHz, and 3 W at 60 GHz can be generated. The design life for those helix tubes is approx. 100,000 hours from the cathode point of view. Looking at coupled cavity tubes the max. voltage is restricted due to EPC-HV-technology to 10 kVmax. With this beam voltage an output power can be achieved which is about a factor of 2.5 - 3 higher than achievable with helix tubes for the same cathode design life of 100,000 hours. Author (ESA)

N78-25297# GTE-Telecomunicazioni S. p. A, Milano (Italy).
LOW-NOISE TRANSPONDER FRONT ENDS: PROSPECTIVE SOLUTIONS
A. DAmbrosio *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 175-180 refs (For availability see N78-25277 16-32)
Avail: NTIS HC A13/MF A01

This contribution aims at providing a preliminary comparison among the possible ways to get a low noise front end at 30 GHz, for the future millimeter wave, high capacity communication satellites. The present state-of-the-art, is given and where possible the technological progress is forecast likely to be effective when these satellites will become operational. The survey includes the resistive mixer, the parametric amplifier, either degenerate or not, the FET amplifier and the parametric down converter.
Author (ESA)

N78-25298 Comsat Corp., Clarksburg, Md.
CURRENT DEVELOPMENTS AT COMSAT LABORATORIES IN THE 20/30-GHz COMMUNICATIONS SATELLITE BANDS
W. J. Getsinger *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 181-186 refs Sponsored by Commun. Satellite Corp. (For availability see N78-25277 16-32)
Avail: NTIS HC A13/MF A01

Some of the microwave technology recently developed at Comsat Laboratories in the 20 and 30 GHz satellite communications band are presented. The Comstar satellite beacons at 19.04 and 28.56 GHz, a 20 GHz parametric amplifier, a simple 20/30 GHz antenna feed, a multiple beam reflector antenna, and progress in active medium propagation in the 20 GHz range are presented. Author (ESA)

N78-25299# Bell Telephone Labs., Inc., Holmdel, N. J.
LONG-TERM RAIN ATTENUATION OBSERVATIONS AT 13, 19 AND 28 GHz
E. E. Muller *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 187-194 refs (For availability see N78-25277 16-32)
Avail: NTIS HC A13/MF A01

The location and equipment for measuring data relating to rain fading are presented. Simultaneous beacon and radiometer measurements are discussed and compared to the earlier radiometer measurements. Sites for the current test series are located in Illinois and Georgia. Beacon and radiometer measuring and recording equipment are located at Grant Park - which is 40 miles south of Chicago; and at Palmetto, 26 miles southwest of Atlanta, Georgia. Diversity sites, Manteno and Temple, which contain a single frequency radiometer only, are approximately

20 miles from the main site. Data from these locations is telemetered to the main site to be recorded simultaneously with local measurements. The antennas at all locations have been directed towards the Comstar D-1 satellite, in geostationary orbit at 128 deg longitude. Author (ESA)

N78-25300# Radio Research Labs., Tokyo (Japan).
PRESENT STATUS OF JAPANESE SATELLITE COMMUNICATIONS PROPAGATION STUDIES FOR FREQUENCIES ABOVE 10 GHz
K. Tao *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 195-201 refs (For availability see N78-25277 16-32)
Avail: NTIS HC A13/MF A01

The most fundamental obstacle encountered in design of satellite communication systems at the frequency bands above 10 GHz is attenuation of radio waves by precipitation, especially by rain. The current knowledge on depolarization due to non-sphericity of falling raindrops and propagation experiments on the earth-space path is described. Three coherent beacon waves of 1.7, 11.5, and 34.5 GHz, emitted from the Engineering Test Satellite type 2 (ETS-2) which was launched in February 1977, were used to measure the attenuation due to rain, together with the C-band rain radar. A comprehensive program of propagation measurements is being made in Japan in connection with the planning of the experimental domestic satellite system for operation at 14/12 GHz and 30/20 GHz. Author (ESA)

N78-25301# Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
THE MEASUREMENT OF COHERENT AND INCOHERENT EM WAVES AT 20 AND 30 GHz DURING INTENSE PRECIPITATION
C. Capsoni, M. Mauri, and A. Paraboni *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 203-208 refs (For availability see N78-25277 16-32)
Avail: NTIS HC A13/MF A01

Some topics concerning coherent and incoherent propagation of millimetric waves in presence of intense precipitations are discussed. As for coherent propagation, a comparison of the performances of systems measuring depolarization is made. Circular polarization is found to possess better characteristics in order to identify the physical properties of the channel; 30 GHz allows better accuracy than 20 GHz as far as propagation is concerned. It is also found that accuracy in linear polarization strongly depends on the site where measurements are made. As for incoherent propagation it is shown that hail can produce a fairly intense diffuse radiation. Multiple scattering is shown to carry most of the energy incident on the antenna. Incoherent to coherent ratio depends strongly on the antenna gain.
Author (ESA)

N78-25302# Portsmouth Polytechnic (England). Dept. of Electrical and Electronic Engineering.
CHOICE OF POLARIZATION FOR AN EARTH-SPACE LINK AT 30 GHz
E. Vilar *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 209-217 refs (For availability see N78-25277 16-32)
Avail: NTIS HC A13/MF A01

Consideration is given to the problem of establishing a reasonably reliable model of excess attenuation in the millimeter region in absence of in-situ radiometer measurements. Two models for the west European region at 30 and 12 GHz are then derived and the 12 GHz model is compared with various radiometer results at 11.4 GHz. Because of the high attenuations at 30 GHz, a closer look is taken to assess the differences in rain attenuation according to the polarization chosen. The results are compared with experimental data and the advantage or disadvantage of using vertical or horizontal rather than circular polarization is discussed. The increase in aerial gain as the diameter increases is compared with diversity gain. Author (ESA)

N78-25303# Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
DEPENDENCE OF SPECIFIC RAIN ATTENUATION AND PHASE SHIFT ON ELECTRICAL, METEOROLOGICAL AND GEOMETRICAL PARAMETERS
E. Damosso *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 219-226 refs (For availability see N78-25277 16-32)
Avail: NTIS HC A13/MF A01

A first effort to obtain simple relationships between specific attenuation/phase shift due to rain and frequency, in the range from 10 to 30 GHz, for four different drop-size distributions, at a water temperature of 20 C, and for elevation angles from 0 to 60 deg. For each relationship, valid for rainfall rates from 5 to 150 mm/h, the regression parameters and the R-square coefficients are given. Author (ESA)

N78-25304# Marconi Space and Defence System Ltd., Stanmore (England).
MEASUREMENT OF PROPAGATION PARAMETERS IN THE 20/30 GHz BANDS
W. P. Robins *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 227-236 refs (For availability see N78-25277 16-32)
Avail: NTIS HC A13/MF A01

The need for accurate measurements of specific listed propagation characteristics in the 20 and 30 GHz bands, particularly the variation with atmospheric conditions over slant paths from a satellite, is outlined together with the desirable accuracy of measurement. Parameters of ground stations typical of those likely to be used for the measurements are tabulated together with the achievable measurement accuracy as limited by thermal noise. Other factors which limit measurement accuracy are also discussed quantitatively. Some consideration is given to the problems of measurement of absolute propagation loss. In cases where the satellite incorporates experimental communication repeaters in the same frequency bands, there are a number of restrictions on the frequency plans which can be chosen. These restrictions are discussed. A satellite beacon equipment which is at present operational is briefly described. Author (ESA)

N78-25305# Technische Hogeschool, Eindhoven (Netherlands).
A RECEIVING SYSTEM FOR EXPERIMENTAL GEOSTATIONARY SATELLITES WITH VERY ACCURATE PHASE DETECTION
J. Dijk and J. M. G. A. Ouderling *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 237-243 refs (For availability see N78-25277 16-32)
Avail: NTIS HC A13/MF A01

A receiving system for the measurement of co and cross-polarization levels as well as the differential phase between both signals is presented. The system is designed for the geostationary satellite OTS which will transmit two carriers with fixed polarization, one linear and one circular. Calculations were carried out for the B1 beacon with circular polarization, assuming a receiver noise temperature of 3000 K and 3 m Cassegrain antenna. These calculations show that depolarization levels up to 50 db below the copolar level may be measured with good accuracy, even when the phase noise of the beacon generator does not allow small loop bandwidths. Author (ESA)

N78-25306# European Space Research and Technology Center, Noordwijk (Netherlands).
A SUMMARY AND ASSESSMENT OF THE 20/30 GHz ATS-6 PROPAGATION DATA COLLECTED DURING THE EUROPEAN PHASE
P. A. Watson *In* ESA Advan. Satellite Commun. Systems using the 20 to 30 GHz Bands Jan. 1978 p 245-249 refs (For availability see N78-25277 16-32)
Avail: NTIS HC A13/MF A01

The 20/30 GHz propagation data collected during the European phase of the ATS-6 program is assessed from a system standpoint. Firstly, attenuation statistics from 9 sites, representing (for 30 GHz) a total data base of 3.3 years, are compared with the ESA long term 11 GHz radiometer data, using suitable scaling factors. The two sets of data are remarkably close. Attention is then drawn to the cross-polarization results from ATS-6 and in particular to the discovery of severe depolarization on transmission through ice particles. Certain features of this type of cross-polarization are described, including a lack of correlation with attenuation and a well defined, near quadrature phase relationship to the copolar channel. Finally the ATS-6 site diversity

measurements and scintillation investigations are discussed.
Author (ESA)

N78-25307# Ohio State Univ., Columbus. Dept. of Electrical Engineering.
ADAPTIVE ARRAYS FOR AM AND FM SIGNALS Quarterly Report, 1 Jun. - 31 Aug. 1977
R. T. Compton, Jr. Feb. 1978 8 p refs
(Contract N00019-77-C-0156)
(AD-A052589; ESL-4618-4) Avail: NTIS HC A02/MF A01 CSCL 17/2

There are three areas of work under this contract. The first involves experimental tests of an adaptive array in an AM communication system. The second involves array experiments with an FM communication system. The third consists of theoretical studies of methods of integrating adaptive arrays into other types of conventional communication systems. The AM and FM communication systems involve the addition of a binary phase switching modulation on conventional AM and FM signals. The purpose of this phase switching is to allow the array to distinguish between the desired signal and interference. Implementation of the system with this phase switching requires an IF delay lock loop for the AM system and a Costas loop and baseband delay lock loop for the FM system, in addition to other minor circuitry. GRA

N78-25308# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
COMPARISON OF FAST FOURIER TRANSFORMS WITH OTHER TRANSFORMS IN SIGNAL PROCESSING FOR TACTICAL RADAR TARGET IDENTIFICATION M.S. Thesis
Robert L. Herron Dec. 1977 179 p refs
(AD-A053347; AFIT/GE/EE/77-20) Avail: NTIS HC A09/MF A01 CSCL 17/9

The High Resolution Radar Branch of the Rome Air Development Center has developed a tactical target identification (TTI) pulsed-Doppler radar system which generates two-dimensional 'images' of aircraft. The signal processing technique utilizes the fast Fourier transform (FFT) to produce a slant-range versus cross-range display. If the TTI system is to be effectively employed in an aerial warfare environment then real-time processing is necessary. In an effort to speedup the signal processing several alternative transforms were studied as possible substitutes for the FFT. The Karhunen-Loeve, Cosine (Sine), Mellin, and Hankel transforms were investigated and found to be infeasible for use in TTI imaging. The Walsh (Hadamard) transform was studied in detail and tested in a simulation program and found that it could not be utilized in the TTI signal processing. Two methods of converting from the Walsh sequency domain to the Fourier frequency domain were studied. The first scheme, a recursive relationship between the arithmetic and logical autocorrelation functions as presented by Robinson was discovered to be incorrect. The second, a method of computing the Fourier coefficients from the Walsh coefficients of a function was demonstrated to be too time consuming to be implemented in TTI signal processing. Several floating-point FFT implementations were tested using the simulation program. Also, several fixed-point FFT algorithms were derived and tested. All of these were evaluated on the basis of speed and memory requirements and one fixed-point FFT algorithm was shown to be fast enough and accurate enough for implementation on the TTI Minicomputer.
Author (GRA)

N78-25309# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.
THE UTILIZATION OF BROADBAND ANTENNAS IN MILITARY TACTICAL COMMUNICATIONS NETS M.S. Thesis
Arthur C. McRae Aug. 1977 427 p
(AD-A053325) Avail: NTIS HC A19/MF A01 CSCL 17/2

This thesis investigates the characteristics of current and developmental broadband antennas used with low and medium power, frequency modulated radio equipment operating in the 30-76 MHz frequency range in military tactical voice radio communication nets. The radio communication net structure of the Airborne and Airmobile Infantry combat units of the Airborne and Air Assault Divisions are used to display data on density of equipment, typical communications ranges, and problems encountered by tactical communications-electronics personnel in providing reliable, secure, responsive, and flexible radio communications within the battle area. Data for the study were assembled from current military communications-electronics and electronic warfare training literature, military communications engineering references, standard electrical engineering textbooks on antenna analysis and design, research and development technical reports submitted to and by the communications-electronics research and development agencies of the United States Army and Marine Corps, and equipment specification sheets and test reports obtained from various manufacturers of military communications-electronics equipment. The results of this study, combined with field testing of various items of radio and antenna equipment conducted at military installations throughout the United States and West Germany, show that use of wideband omnidirectional and, particularly, wideband directional antennas can enhance both the communications reliability and flexibility of combat units, and at the same time provide a much greater degree of communications security and defense against enemy electronic countermeasures. GRA

N78-25310# Ohio State Univ., Columbus. Electroscience Lab.
ADAPTIVE ARRAYS FOR AM AND FM SIGNALS Quarterly Report, 1 Sep. - 30 Nov. 1977
R. T. Compton, Jr. Feb. 1978 9 p
(Contract N00019-77-C-0156)
(AD-A053104; ESL-4618-5) Avail: NTIS HC A02/MF A01 CSCL 09/4

This report describes progress under NASC Contract N00019-77-C-0156 during the fourth quarterly period. There are three areas of work under this contract. The first involves experimental tests of an adaptive array in an AM communication system. The second involves array experiments with an FM communication system. The third consists of theoretical studies of methods of integrating adaptive arrays into other types of conventional communication systems. The AM and FM communication systems involve the addition of a binary phase switching modulation on conventional AM and FM signals. The purpose of this phase switching is to allow the array to distinguish between the desired signal and interference. Implementation of the system with this phase switching requires an IF delay lock loop for the AM system and a Costas loop and baseband delay lock loop for the FM system, in addition to other minor circuitry.
Author (GRA)

N78-25311# Lincoln Lab., Mass. Inst. of Tech., Lexington.
NETWORK SPEECH PROCESSING PROGRAM Annual Report, 1 Oct. 1976 - 30 Sep. 1977
Melvin A. Herlin and Theodore Bially 30 Sep. 1977 82 p refs
(Contract F19628-76-C-0002)
(AD-A053015; ESD-TR-77-337) Avail: NTIS HC A05/MF A01 CSCL 09/4

This report covers work performed during FY 1977 on the DCA Network Speech Processing Contract. Three general areas of work are reported in this document: secure voice conferencing, speech algorithm studies, and bandwidth efficient communications.
Author (GRA)

N78-25312# Illinois Univ., Urbana-Champaign. Dept. of Electrical Engineering.
STUDY OF MICROSTRIP ANTENNAS, MICROSTRIP PHASED ARRAYS, AND MICROSTRIP FEED NETWORKS Final Report, 2 Feb. 1976 - 9 Sep. 1977
Y. T. Lo, D. Solomon, F. R. Ore, D. D. Harrison, and G. A. Deschamps Dec. 1977 171 p refs
(Contract F19628-76-C-0140; AF Proj. 2305)
(AD-A053005; UIEM-77-23; UILU-ENG-77-2265; RADC-TR-77-406) Avail: NTIS HC A08/MF A01 CSCL 09/5

Microstrip antennas are inherently narrow band devices with low efficiency. On the other hand, they have many unique and attractive properties: they are low in profile, light in weight, compact and conformable in structure, and easy to fabricate and to be integrated with solid-state devices. They are superior to the conventional flush-mount antennas since they are truly

thin antennas, requiring no cavity backing. There seems to be little doubt that they will find more and more applications as more compact efficient solid state sources, amplifiers, and self-matching networks are developed to compensate for the shortcomings. In this investigation a simple and useful theory, based on the cavity model, has been developed to analyze and predict the fundamental behavior of microstrip antennas of various basic shapes. In general, there is a good agreement between the theory and experiment. GRA

N78-25313# Boeing Aerospace Co., Seattle, Wash. Logistics Support and Services.
INTEGRATED APPLICATIONS OF AUTOMATED SPEECH TECHNOLOGY Final Technical Report
Robert L. Feuge (Logicon, Inc.) and Charles W. Geer 14 Feb. 1978 70 p
(Contract N00014-77-C-0401)
(AD-A053189; D194-10025-1) Avail: NTIS HC A04/MF A01 CSCL 17/2

The work performed and results obtained during the conduct of the Integrated Aspects of Automated Speech Technology (AST) study contract are documented in this report. The report is intended to supplement the accompanying Program Plan in order to be of assistance in understanding the methodology and limitations of both this study program and the Program Plan document. Four of the major program tasks; AST Technical Review, Crew Station Design Application, Performance Measurement, and Training Applications are described. The technical review includes the rationale behind automatic speech recognition applications, application programs, human factors aspects of AST, and a summary of the technology. Crew Station Design Applications cover the baseline mission selection, the P-3C baseline description, crew task analysis, applications rating process, and a subsystem versus generic tasks potential payoff matrices development process. Recommended AST applications are provided along with scheduling data. Author (GRA)

N78-25314# Air Force Geophysics Lab., Hanscom AFB, Mass.
CORRECTION FOR IONOSPHERIC REFRACTION FOR COBRA DANE Air Force Surveys in Geophysics
Richard S. Allen, Delia E. Donatelli, and Maria C. Picardi 18 Nov. 1977 19 p refs
(AD-A053222; AFGL-TR-77-0257; AFGL-AFSG-376) Avail: NTIS HC A02/MF A01 CSCL 17/9

A hit-to-hit correction for range error arising from ionospheric refraction has been developed for the COBRA DANE radar. First a FORTRAN procedure was developed to compute monthly median refraction corrections over the field of view. These were provided to the radar in the form of equivalent look-up tables. A FORTRAN program was developed for the radar computed index values for each target position (azimuth, elevation, and range) and a correction was determined for each radar hit. This procedure removed about 75 percent of the monthly mean ionospheric effect. A further reduction was then made by using a first and update factor determined by the Air Force Global Weather Central and then a more accurate update derived from a two-frequency calibration made by the radar itself. These procedures are shown to be capable of removing up to 90 percent of the mean ionospheric effect. Author (GRA)

N78-25315# Sandia Labs., Albuquerque, N. Mex.
METHOD OF STREETER AND WYLIE FOR MULTIDIMENSIONAL WAVE PROPAGATION
Randall K. Cole, Jr. 1977 3 p refs Presented at the Am. Nucl. Soc. Meeting, San Francisco, 28 Nov. - 2 Dec. 1977
(Contract EY-76-C-04-0789)
(SAND-77-0549C; Conf-771109-48) Avail: NTIS HC A02/MF A01

Fluid dynamic and wave propagation problems in two or three dimensions are sometimes calculated using the method of Streeter and Wylie. In this method, the fluid sheet or volume is represented by a network or lattice of fluid-filled pipes having finite flow-area, but assumed to intersect at ideal points. The one-dimensional equations are then solved for each pipe (or leg) subject to continuity of pressure and to conservation of mass at each junction (or node). It is explicitly demonstrated that the Streeter-Wylie method, with a first-order-accurate one-dimensional algorithm for the legs, provides a first-order accurate algorithm for the two-dimensional fluid equations in the linear acoustic limit where the particle velocity is much less than the sonic velocity, and where material properties are time-dependent. Results for several simple example calculations are presented and compared with known exact results. ERA

N78-25316# Sandia Labs., Albuquerque, N. Mex.
INTEGRATION AND INTERPOLATION OF SAMPLED WAVEFORMS
S. D. Stearns 1978 17 p
(Contract EY-76-C-04-0789)
(SAND-77-1643) Avail: NTIS HC A02/MF A01

Methods for integrating, interpolating, and improving the signal-to-noise ratio of digitized waveforms are discussed with regard to seismic data from underground tests. The frequency-domain integration method and the digital interpolation method of Schafer and Rabiner are described and demonstrated using test data. The use of bandpass filtering for noise reduction is also demonstrated. With these methods, a backlog of seismic test data has been successfully processed. ERA

N78-25317# National Technical Information Service, Springfield, Va.
ANTENNA ARRAYS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1978
William E. Reed Mar. 1978 193 p Supersedes NTIS/PS-77/0263; NTIS/PS-76/0311
(NTIS/PS-78/0311; NTIS/PS-77/0263; NTIS/PS-76/0311) Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

The bibliography cites reports from worldwide research on antenna arrays. Topics include design, propagation, antenna radiation patterns, mathematical analysis, signal processing, and interference rejection. Phased array studies are excluded. GRA

N78-25318# Systems Applications, Inc., San Rafael, Calif.
REGULATION AND TECHNOLOGY CHOICE IN TELECOMMUNICATIONS Final Report
George P. Mandanis, Laurence Liu, and Dinesh Kamath Sep. 1977 297 p refs
(Grant NSF PRA-75-15637-A01)
(PB-277335/6; TF77-27R; NSF/PRA-7515637/1/8) Avail: NTIS HC A13/MF A01 CSCL 17B

Two alternatives to rate-of-return regulation are analyzed in terms of their effects on economic efficiency and technology choice: the alternative regulatory environments under the sliding scale plan and the cost efficiency plan were simulated for a telecommunications common carrier using a computer model of a real long-haul network and real technologies. Capital structure and important financial variables were carefully accounted for. Among three regulatory forms tested--rate-of-return, sliding scale, and cost efficiency--the cost efficiency plan was found the most promising method for encouraging efficient technology choice. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N78-25319* National Aeronautics and Space Administration. Pasadena Office, Calif.
SWEPT GROUP DELAY MEASUREMENT Patent
David L. Trowbridge, inventor (to NASA) (JPL) Issued 11 Apr. 1978 5 p Filed 24 Nov. 1976 Supersedes N77-17358 (15 - 08, p 1025 Sponsored by NASA
(NASA-Case-NPO-13909-1; US-Patent-4,084,132; US-Patent-Appl-SN-744477; US-Patent-Class-324-57DE; US-Patent-Class-324-57SS; US-Patent-Class-324-58A) Avail: US Patent Office CSCL 09C

Direct recording of group delay measurements on a system

under temperature and stress tests employs modulated carrier frequency sweep over an S or X band. Reference path and test paths to separate detectors utilize a power divider e.g., a directional coupler or a hybrid T junction. An initially balanced phase comparator is swept in frequency by modulated carrier over the band of interest for different conditions of temperature and/or mechanical stress to obtain characteristic group delay curves.
Official Gazette of the U.S. Patent Office

N78-25320*# DCA Reliability Lab., Sunnyvale, Calif. Special Products Div.
JAN TRANSISTOR AND DIODE CHARACTERIZATION TEST PROGRAM FOR JANTX TRANSISTOR 2N2605 Final Report
Hiro Takeda Feb. 1978 147 p
(Contract NAS8-31944)
(NASA-CR-150718) Avail: NTIS HC A07/MF A01 CSCL 09A

The objective of this characterization program is to provide the necessary data to create a new class of 19500 detail specifications JAN A CLASS. Author

N78-25321*# Delco Electronics, Santa Barbara, Calif.
ELECTROMECHANICAL FLIGHT CONTROL ACTUATOR, VOLUME 1 Final Report
Jan. 1978 169 p 3 Vol.
(Contract NAS9-14952)
(NASA-CR-151733; R78-1-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 09C

An electromechanical actuator was developed that will follow a proportional control command with minimum wasted energy to demonstrate the feasibility of meeting space vehicle actuator requirements using advanced electromechanical concepts. The approach was restricted to a four-channel redundant configuration. Each channel has independent drive and control electronics, a brushless electric motor with brake, and velocity and position feedback transducers. A differential gearbox sums the output velocities of the motors. Normally, two motors are active and the other two are braked. Author

N78-25322*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
TEST REPORT FOR TWINAX CABLE (ROCKWELL TYPE MB0150-051)
G. D. Doland Apr. 1978 42 p
(Contract NAS9-15200)
(NASA-CR-151725; LEC-12088) Avail: NTIS HC A03/MF A01 CSCL 09C

A controlled impedance twisted pair shielded cable was tested to determine the frequency response and effects of mismatched termination. It was found that a long length of this cable, about 100 feet, exhibited a frequency sensitive attenuation roll-off greater than 1.5 db down at 5 MHz. It was also determined that improper termination resulted in losses of 1/2 to 1 db within the frequency range of 200 KHz to greater than 1-1/2 MHz. The test results indicate a possible problem where mismatched connectors are used in video signal cables. Author

N78-25323*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIQUID METAL SLIP RING Patent Application
Frank D. Berkopec, Robert R. Lovell, and David H. Culp, inventors (to NASA) Filed 17 Apr. 1978 11 p
(NASA-Case-LEW-12277-2; US-Patent-Appl-SN-896955) Avail: NTIS HC A02/MF A01 CSCL 09C

The liquid metal electrical device includes a rotor with a channel for retaining the liquid by tension. The device also includes a stator in the form of a brush partially immersed in the metal. The brush is bidirectionally symmetrical so that whichever direction the rotor turns, the probe presents the same physical resistance and affords the same electrical conductivity as a connection between the probe and the rotor. NASA

N78-25324# Communications Research Centre, Ottawa (Ontario). Space Technology and Applications Branch.
DIELECTRICS AND SPACECRAFT CHARGING
W. D. Edwards Apr. 1978 22 p refs
(CRC-1317) Avail: NTIS HC A02/MF A01

The assumption is made that spacecraft charging effects may be alleviated by using conducting dielectrics for spacecraft construction. The sources of charge within dielectrics are considered. The conductivity of dielectrics is discussed in terms of the charge carrier density (a) and the mobility (mu). An examination is made of the ways in which n and mu might be increased in a manner suitable for satellite use. Methods of reducing the spacecraft potential with respect to the plasma are also considered. Recommendations are made and the steps to be taken are suggested. Author

N78-25325# Washington Univ., St. Louis, Mo.
IMPURITY AND DEFECT BEHAVIOR IN HIGH-PURITY EPITAXIAL GaAs Interim Report, 1 Jan. - 31 Dec. 1977
C. M. Wolfe 31 Dec. 1977 6 p
(Grant AF-AFOSR-2950-76)
(AD-A053116; SR-2) Avail: NTIS HC A02/MF A01 CSCL 20/12

This report summarizes research performed in an effort to obtain a better understanding of impurity and defect behavior in epitaxial GaAs. This work includes the identification of residual defects, the development of a model for impurity incorporation, and an examination of impurity gradient effects. Author (GRA)

N78-25326# Sperry Research Center, Sudbury, Mass.
AUTOMATED SIX-PORT MICROWAVE CALIBRATION SYSTEM Final Technical Report, 9 Jun. 1975 - 30 Nov. 1976
H. M. Cronson and L. Susman Apr. 1977 76 p refs
(Contract DAAH01-75-C-1112)
(AD-A053031; SRC-CR-77-32) Avail: NTIS HC A05/MF A01 CSCL 14/2

This report presents the results of research on the analysis, design, fabrication, and testing of an automated microwave six-port system to meet the field calibration requirements of the Army Metrology and Calibration Center. A matrix description of the six-port junction is used as the basis for a new calibration procedure. A re-examination of the self-calibration procedure as an eigenvalue problem results in new insights and a faster numerical computation. The Sperry programmable calculator controlled six-port system described herein is designed to measure S11 and S21 over the frequency range 2 to 18 GHz without perturbing the device under test. Measurements on the completed system taken from 7 to 12 GHz show that results within 1% can be obtained. Indications are that with further hardware and software improvements, considerably better performance could reliably be achieved. Author (GRA)

N78-25327# Army Missile Research and Development Command, Redstone Arsenal, Ala. Engineering Lab.
THERMAL CHARACTERISTICS OF HYBRID CIRCUITS
Joseph Agosta, Stephie G. Das, Richard Ribbe, Charles E. Riley, and Victor W. Ruwe 12 May 1977 83 p
(DA Proj. 1W3-62303-A-214)
(AD-A053009; DRDMI-EA-77-1) Avail: NTIS HC A05/MF A01 CSCL 09/3

This report presents an evaluation of thermal resistance in hybrid microelectronics. Four different package types were used with and without multiple layer thick circuitry. Chip components were attached using both epoxy and eutectic methods.
Author (GRA)

N78-25328# Army Missile Research and Development Command, Redstone Arsenal, Ala. Engineering Lab.
THICK-FILM FINE LINE PRINTING Final Report
Victor W. Ruwe, Kenneth Dean, and Robert E. Sulouff Sep. 1977 25 p
(DA Proj. 1W3-62303-A-214)
(AD-A053010; DRDMI-E-78-1) Avail: NTIS HC A02/MF A01 CSCL 09/5

This report discusses the significant parameters in fine line printing (less than 0.005 lines and spaces) of thick-film microelectronic circuits. These considerations of the materials, substrate, paste rheology and the interaction of the elements in the manufacturing process are reported. The documented results of the experimental work are presented demonstrating 3-mil lines and spaces. The yield is presented as a function of line spacing,

width, and length. The conclusions include process parameters to duplicate the results. Author (GRA)

N78-25329# Honeywell, Inc., St. Petersburg, Fla. Avionics Div.

MANUFACTURING METHODS AND TECHNOLOGY ENGINEERING FOR TAPE CHIP CARRIER Quarterly Report, 1 Oct. - 31 Dec. 1977

William R. Rodrigues de Miranda and Stanton R. Jones Feb. 1978 71 p

(Contract DAAB07-77-C-0526)

(AD-A053088; ERADCOM-77-0526-2) Avail: NTIS HC A04/MF A01 CSCL 13/8

This report describes the work performed during the second quarter of a 26 month contract. The contract is aimed at establishing and demonstrating the feasibility of an automated assembly line for hybrid microcircuits using tape chip carrier technology for semiconductor devices whenever practical. The automated line will also make use of automatic substrate handling equipment to move partially assembled devices in and out of magazines. Author (GRA)

N78-25330# Radio Corp. of America, Lancaster, Pa. SSD-Electro-Optics and Devices.

MANUFACTURING METHODS AND TECHNOLOGY (MM AND T) MEASURE FOR FABRICATION OF SILICON TRANSCALENT THYRISTOR Quarterly Progress Report, 1 Oct. - 31 Dec. 1977

B. B. Adams, S. W. Kessler, R. E. Reed, and D. R. Trout Jan. 1978 54 p

(Contract DAAB07-76-C-8120)

(AD-A053089; QPR-5) Avail: NTIS HC A04/MF A01 CSCL 09/1

This fifth quarterly report describes the progress on the MM and TE program for Transcalent (Heat-Pipe cooled) thyristors. Production engineering measures for the device and the pertinent state-of-the-art on the sample devices are included. Initial test results on the first confirmatory samples are listed. The present status includes the submission of the Test Plan for the confirmatory samples, the fabrication of the confirmatory sample devices, the engineering analyses of the initial test results on these devices, and the equipment refinements being procured for this program. Plans for the next quarter include the conclusion of the confirmatory sample phase, the preparation of the test report for these confirmatory samples, as well as the preparations for the pilot run phase. Author (GRA)

N78-25331# TRW Defense and Space Systems Group, Redondo Beach, Calif.

TED BPSK MODULATOR/DEMODULATOR INTEGRATED CIRCUIT DEVELOPMENT Final Technical Report, Feb. 1976 - Jul. 1977

Dale C. Claxton, Ted D. Leisher, and Tom G. Mills Jan. 1978 76 p

(Contract N00014-76-C-0570; RF54582001)

(AD-A053051) Avail: NTIS HC A05/MF A01 CSCL 09/5

This program had two basic objectives: to develop processing techniques suitable for the fabrication of small scale gallium arsenide (GaAs) integrated circuits, and to fabricate and evaluate GaAs biphase shift-keyed (BPSK) integrated circuit modulators and demodulators operating at 5 GHz carrier frequencies. GaAs integrated circuits require, as a minimum, field effect transistors (FET's), resistors, and interconnection metals. Previous TRW studies had shown that the addition of planar, gate controlled transferred electron devices (TED's), capacitors, and multilevel metals for undercrossings would facilitate the implementation of circuits which could perform useful microwave functions with a low device count and at fairly high frequencies. The design goals for the modulator and demodulator circuits were operational at 5 GHz carrier frequency and 1 Gbps data rate with minimum dc power. The circuit designs are distinctly nonconventional, having been developed specifically for implementation with the TED's. The TED's are used basically as phase logic AND gates, while the FET's are used as linear amplifiers. Both circuits generally exceeded the design goals: the modulator circuit operates from 4.5 to 8 GHz carrier frequency, 0 to 1.4 Gbps data rate, and 440 mW dc power; the demodulator operates from 4 to 10 GHz carrier frequency, 0 to 1.6 Gbps data rate, and 235 mW dc power. The IC chips are roughly 75 mils square and are mounted in test fixtures whose volume is 0.75 cu.in. GRA

N78-25332# Defence Research Establishment Pacific, Victoria (British Columbia).

SEMI-CONDUCTOR PHOTON DETECTORS: A REVIEW OF THE LITERATURE AND AN EVALUATION FOR SPECTRO-CHEMICAL APPLICATIONS

M. J. Collins and C. A. Waggoner Jul. 1977 34 p refs

(AD-A053038; DREP-TM-77-9) Avail: NTIS HC A03/MF A01 CSCL 09/1

The operational characteristics of current semi-conductor photon detectors are reviewed. Particular attention is paid to comparison of these experimental detectors with the conventional photomultiplier tube. The semi-conductor detectors offer significant advantages for multielement analyses in fields such as atomic absorption and atomic emission spectroscopy. Relevant literature is listed and abstracted. Author (GRA)

N78-25333# Army Research Inst. for the Behavioral and Social Sciences, Arlington, Va.

AN EVALUATION OF VISUAL SEARCH BEHAVIOR ON A CATHODE RAY TUBE UTILIZING THE WINDOW TECHNIQUE Progress Report, Jul. 1975 - Sep. 1976

Thomas M. Granda Feb. 1978 67 p refs

(AD-A053352; ARI-Technical-Paper-283) Avail: NTIS HC A04/MF A01 CSCL 05/8

The visual search task in this experiment involved two components: (1) moving or changing of stimuli viewed in the window of a cathode ray tube (CRT), and (2) processing of the stimulus information. In order to view the entire stimulus field, searchers needed to control which section of the super-display they saw in the window. The motion relationship between the entire display and the window is analogous to that involving the principle of the moving part. The present study considered whether the super-display should be the static component and the window the moving component or, whether the super-display should be the moving component and the window the static component. The second aspect of this experiment considered how stimulus information is processed, in relation to the length of a memorized target list. This aspect evaluated two general models of human information processing: serial and parallel. Ten participants searched a series of alphanumeric displays, presented on a CRT, for specific numeric stimuli (targets). Independent variables were display motion control, length of target list, target density, non-target density, and window size. The effect of time on performance was also measured by blocking trials. Each participant performed at all levels of each variable except display motion. Five participants controlled window motion, and five controlled super-display motion. The basic experimental design consisted of a modified central composite design taken from response surface methodology. GRA

N78-25334# Naval Research Lab., Washington, D. C. Plasma Physics Div.

INDUCTIVE CHARGING OF PULSE LINES ON 0.1 TO 0.1 MJ RANGE USING FOIL FUSES STAGED WITH EXPLOSIVELY ACTUATED SWITCHES Interim Report

D. Conte, R. Ford, W. H. Lupton, J. D. Shipman, Jr., P. Turchi, and I. M. Vitkovitsky Mar. 1978 25 p refs Sponsored by DNA

(AD-A053309; NRL-MR-3742) Avail: NTIS HC A02/MF A01 CSCL 09/3

The use of inductive storage techniques to replace the conventional high voltage sources, such as Marx generators, for the charging of high voltage transmission line pulse generators (i.e., capacitive loads) is discussed. The proposed opening switch system consists of exploding foil fuses staged with high explosive actuated switches. The low resistance of the explosive switches in the closed stage allows the inductive store to be charged at relatively slow rates without significant energy loss. Upon opening, current is commutated to the foils which rapidly explode to generate the inductive voltage necessary to charge the load. A detailed analysis of fuse performance in the basic inductive storage circuit is presented using empirically obtained data on the resistivity vs. dissipated energy characteristic of vaporized aluminum foils. The results are used to outline the design of inductive storage systems for pulse charging capacitors

to 1 MV at energies from 100 to 1000 kJ, with risetimes of 2 to 10 microsec 10 to the 11th power to 10 to the 12th power W rate and efficiencies of 20 to 65%. Author (GRA)

N78-25335# Los Alamos Scientific Lab., N. Mex.
DEVELOPMENT OF A LOW COST, 10 kV CAPACITOR
E. L. Kemp, G. P. Boicourt, and K. J. Bickford 1977 4 p refs Presented at 7th Symp. on Fusion Res. Proj., Knoxville, Tenn., 25-28 Oct. 1977
(Contract W-7405-eng-36)
(LA-UR-77-2408; Conf-771029-32) Avail: NTIS HC A02/MF A01

The cost of an energy storage capacitor is largely determined by the quantity of material in it. Labor cost is typically less than 25 percent of the total cost. A 170 F, 10 kV capacitor has been developed which presently sells for less than four cents per joule. The 10 kV rating was chosen because this is the optimum voltage for minimum cost. A development specifications was written to evaluate only a single parameter such as paper thickness and a small number of capacitors were purchased and tested to destruction in a standardized 85 kJ test bank. The capacitors were then dissected to determine cause of failure. Over six designs have been evaluated. Recently a new dielectric sandwich and a new impregnant have been evaluated with encouraging results. The details of the various designs, the test conditions and the test results are presented. ERA

N78-25336# Los Alamos Scientific Lab., N. Mex.
SPARK GAP OVERPRESSURES IN THE TRANSFER CAPACITOR DEVICE
L. C. Burkhardt and R. S. Dike 1977 4 p refs Presented at 7th Symp. on Fusion Res. Proj., Knoxville, Tenn., 25-28 Oct. 1977
(Contract W-7405-eng-36)
(LA-UR-77-2417; Conf-771029-29) Avail: NTIS HC A02/MF A01

A designer of spark gaps is often faced with two gas pressure problems, one static and one dynamic. The former is easy to obtain data on which to base intelligent design specifications; about the latter, less is known. The total internal pressure environment was measured in an un-time-resolve way, in order to give the designer some rationale in designing gaps of this category. Overpressures of approximately 400 PSI in a 13 cubic inch gap passing currents of approximately 200 kA were measured. ERA

N78-25337# United Technologies Research Center, East Hartford, Conn.
VENTURE ANALYSIS CASE STUDY OF COMBINED GAS AND STEAM POWER SYSTEMS FOR THE GENERATION OF UTILITY ELECTRIC POWER Technical Progress Report, 16 Oct. - 15 Nov. 1977
W. R. Davison 1 Dec. 1977 17 p refs
(Contract EX-77-C-01-2483)
(APAE-2483-5; TPR-5; R77-952907-5) Avail: NTIS HC A02/MF A01

A logical and consistent framework of venture analysis which could be used by government personnel to analyze a wide variety of business related programs was defined. The use of the methodology was demonstrated in analyzing the potential commercialization of the gas turbine as part of combined gas and steam (COGAS) systems for the generation of utility electric power in the period through 2000. The study was conducted in three phases: simulation of the venture from the specific standpoint of the private sector gas turbine manufacturers; identification and quantification of the social benefits which would accompany the commercialization of COGAS systems; and estimation of government assistance and incentives required to assure the commercial development of the system. Extension of the diffusion analysis model to multicompetitor situations was undertaken and calculations of initial deterministic venture returns as well as estimates of the sensitivity of the results to variations in the individual input parameters were made. Author

N78-25338# General Atomic Co., San Diego, Calif.
MB-M75(B) RADIOISOTOPE THERMOELECTRIC GENERATOR RELIABILITY ANALYSIS
J. C. Bass, N. B. Elsner, and H. G. Staley Nov. 1977 16 p
(Contract EY-76-C-03-0167-060)
(GA-A-14724) Avail: NTIS HC A02/MF A01

An analysis was performed to determine where and how the generator can be adversely affected and what procedures could be adapted to minimize the degradation. The areas analyzed were: (1) shock and vibration effects and the proof testing that will be conducted on each RTG; (2) the generator case including the electrical feed throughs, welds, pinch-off tube, and consequences of a case leak; (3) the thermal shields, how they can fail and the consequences if they do fail; (4) the capsule holder tie wires and the consequences of their failure; (5) the capsule holder; (6) the thermoelectric module; (7) the getter, and consequences of its failure; (8) lead wire connections from the module to the feedthrough; and (9) shipping. ERA

N78-25339# State Univ. of New York, Buffalo.
INVESTIGATION OF FEASIBILITY OF VACUUM-ARC FAULT-CURRENT LIMITING DEVICE Final Report,
A. S. Gilmour, Jr. Dec. 1977 149 p refs Prepared for EPRI (EPRI Proj. 476-1)
(EPRI-EL-538) Avail: NTIS HC A07/MF A01

The feasibility of a vacuum arc fault current limiter was investigated. A magnetic field was used to interrupt or control the current flow in a vacuum arc device. The configuration of the device is such that electron current is forced to flow primarily radially outward from the end of a relatively small rod shaped cathode to a ring shaped anode. Control was achieved through the application of magnetic field. Operation at current levels in the 5 to 10 kA range were demonstrated for periods up to about 8 ms. The voltage of operation that was demonstrated is less than required because of discharge paths that develop within the device in parallel with the desired path from the cathode to the anode. Significant progress was made in eliminating these discharge paths by using insulating shields between the anode and the cathode support structure. ERA

N78-25340# Johnson (Bernard), Inc., Houston, Tex.
REPORT ON EMERGENCY ELECTRICAL POWER SUPPLY SYSTEMS FOR NUCLEAR FUEL CYCLE AND REACTOR FACILITIES SECURITY SYSTEMS
1977 70 p
(Contract W-7405-eng-26)
(Y/Sub-77-14263/1) Avail: NTIS HC A04/MF A01

Basic considerations for establishing system requirements for emergency electric power systems for physical security and special nuclear materials accountability operations are presented. Methods of supplying emergency power that are available at present and methods predicted to be available in the future are discussed. The characteristics of capacity, cost, safety, reliability and environmental and physical facility considerations of emergency electric power techniques are presented. Considerations for the development of a system concept and the preparation of a detailed system design are included. ERA

N78-25341# Bendix Corp., Kansas City, Mo.
IMPROVED METHODS OF FABRICATING MULTILAYER PRINTED WIRING BOARDS Final Report
J. L. Wilson Jan. 1978 43 p refs
(Contract EY-76-C-04-0613)
(BDX-613-1657) Avail: NTIS HC A03/MF A01

A reliable process for the fabrication of multilayer printed wiring boards was improved by implementing a solder-dip-and-level process in place of the conventional pattern-tin-lead-plate process. An economical, disposable polyvinyl fluoride film release sheet was adopted, and a nuclear static electricity eliminator was effective in providing lint free panels. ERA

N78-25342# Stanford Univ., Calif. Edward L. Ginzton Library.
SUPERCONDUCTING POWER TRANSMISSION LINE MATERIALS RESEARCH AND CONDUCTOR DEVELOPMENT Final Report
T. H. Geballe and M. R. Beasley Jul. 1977 96 p refs
(Contract EY-76-S-03-0326)
(SAN/0326-1) Avail: NTIS HC A05/MF A01

The feasibility of transferring the conductor technology developed on tubes to more practical tape conductors was investigated and studies aimed at improving the basic understand-

ing of the important superconducting properties crucial to superconducting power transmission line (SPTL) applications were continued. The major objectives were: to produce one to three meter long tapes of multi-layered prototype Nb3Sn tape conductors based on the results obtained earlier on tubular conductors. Also to measure the electrical characteristics of these conductors at 4.2 K; to study the dynamics of the flux penetration process in superconductors at low fields; to study and attempt to improve the stability of SPTL conductors; to investigate codeposited third element depositions using electron beam coevaporation as an alternative to layering to achieve growth morphologies conducive to strong flux pinning; and to complete dielectric studies. ERA

N78-25343# Los Alamos Scientific Lab., N. Mex.
AVALANCHE TRANSISTOR PULSER FOR FAST-GATED OPERATION OF MICRO-CHANNEL PLATE IMAGE-INTENSIFIERS
A. Lundy, J. R. Parker, J. S. Lunsford, and A. D. Martin 1977 8 p refs Presented at Nucl. Sci. Symp., San Francisco Calif., 19 Oct. 1977
(Contract W-7405-eng-36)
(LA-UR-77-2402; Conf-771023) Avail: NTIS HC A02/MF A01

Transistors operated in the avalanche mode are employed to generate a 1000 volt 10 to 30 nsec wide pulse with less than 4 nsec rise and fall times. This pulse is resistively attenuated to approximately equal to 270 volts and drives the image intensifier tube which is a load of approximately equal to 200 pf. To reduce stray inductance and capacitance, transistor chips were assembled on a thickfilm hybrid substrate. Circuit parameters, operating conditions, and coupling to the microchannel plate image-intensifier tube are described. To provide dc operating voltages and control of transient voltages on the image-intensifier tube a resistance-capacitance network has been developed which (1) places the image-intensifier output phosphor at ground, (2) provides programmable gains in f-stop steps, and (3) minimizes voltage transients on the image-intensifier tube. ERA

N78-25344# Bendix Corp., Kansas City, Mo.
CONTAMINANT CLEANING FOR CRITICAL ELECTRICAL ASSEMBLY AREAS Final Report
L. C. Jackson Feb. 1978 70 p refs Revised
(Contract EY-76-C-04-0613)
(BDX-613-1695-Rev) Avail: NTIS HC A04/MF A01

The aspects of surface cleanliness studied include contaminant detection, concentration measurements, contaminant characterization, contaminant removal by solvents and solvent blends, cleaning process effectiveness, surface characterization, and electrical properties of contaminated surfaces. Correlations were established between Meseran surface analyzer radioactive surface energy probe measurements and solubility parameter values, surface tension values of known liquids and solids (plastics), and concentrations of polar and nonpolar contaminants. Principles of evaporative rate analysis and solubility parameter are described, which together provide the foundation for a new technology of understanding of surface chemistry. ERA

N78-25345# National Technical Information Service, Springfield, Va.
CHARGE TRANSFER DEVICES, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Mar. 1976 - Mar. 1977
William E. Reed Mar. 1978 247 p
(NTIS/PS-78/0308) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09C

Research reports from worldwide literature are cited which cover the technology, design, fabrication, and applications of charge transfer devices. Applications include image devices, signal processors, amplifiers, filters, and memory devices. An updated bibliography containing 239 abstracts is presented. Author

N78-25346# National Technical Information Service, Springfield, Va.
CHARGE TRANSFER DEVICES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1978
William E. Reed Mar. 1978 251 p Supersedes NTIS/PS-77/0269; NTIS/PS-76/0240; NTIS/PS-75/275
(NTIS/PS-78/0307; NTIS/PS-77/0269; NTIS/PS-76/0240; NTIS/PS-75/275) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09C

The technology, design, fabrication, and applications of charge transfer devices are presented in the cited Federally sponsored research reports. Applications include imaging, signal processing, detectors, filters, amplifiers, and memory devices. An updated bibliography containing 246 abstracts is presented. Author

N78-25347# National Technical Information Service, Springfield, Va.
CHARGE TRANSFER DEVICES, VOLUME 3. CITATIONS FROM THE ENGINEERING DATA BASE Progress Report, Apr. 1977 - Mar. 1978
William E. Reed Mar. 1978 161 p Supersedes NTIS/PS-77/0271; NTIS/PS-76/0241
(NTIS/PS-78/0309; NTIS/PS-77/0271; NTIS/PS-76/0241) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09C

Research reports from worldwide literature are cited which cover the technology, design, fabrication, and applications of charge transfer devices. Applications include image devices, signal processors, amplifiers, filters, and memory devices. An updated bibliography containing 205 abstracts is presented. Author

N78-25348# National Technical Information Service, Springfield, Va.
STRIP TRANSMISSION LINES, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, Mar. 1976 - Mar. 1978
William E. Reed Mar. 1978 187 p Supersedes NTIS/PS-77/0288; NTIS/PS-76/0254; NTIS/PS-75/239
(NTIS/PS-78/0298; NTIS/PS-77/0288; NTIS/PS-76/0254; NTIS/PS-75/239) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09C

The technology and applications of strip transmission lines are presented in the cited Federally-sponsored research reports. The topics include amplifiers, antennas, microstrip, integrated circuits, and couplers. GRA

N78-25349# National Technical Information Service, Springfield, Va.
STRIP TRANSMISSION LINES, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Mar. 1976 - Mar. 1978
William E. Reed Mar. 1978 228 p Supersedes NTIS/PS-77/0290; NTIS/PS-76/0255
(NTIS/PS-78/0299; NTIS/PS-77/0290; NTIS/PS-76/0255) Copyright. Avail: NTIS HC $28.00/MF $28.00

Research reports from worldwide literature are cited covering the technology, design, and applications of strip transmission lines. The applications include antennas, integrated circuits, microstrip devices, and microwave components. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N78-25350* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FLEXIBLE PILE THERMAL BARRIER INSULATOR Patent
George Edward Anderson(Rockwell Intern., Downey, Calif.),Donald Maurice Fell (Rockwell Intern., Downey, Calif.), and Jerry Stanley Tesinsky, inventors (to NASA) (Rockwell Intern., Downey, Calif.) Issued 7 Mar. 1978 5 p Filed 28 Apr. 1976 Supersedes N76-23585 (14 - 14, p 1803) Sponsored by NASA
(NASA-Case-MSC-19568-1; US-Patent-4,078,110; US-Patent-Appl-SN-681000; US-Patent-Class-428-93; US-Patent-Class-49-479; US-Patent-Class-49-485; US-Patent-Class-49-DIG.1; US-Patent-Class-428-94; US-Patent-Class-428-95; US-Patent-Class-428-96; US-Patent-Class-428-97; US-Patent-Class-428-913) Avail: US

Patent Office CSCL 20D

A flexible pile thermal barrier insulator included a plurality of upstanding pile yarns. A generally planar backing section supported the upstanding pile yarns. The backing section included a plurality of filler yarns forming a mesh in a first direction. A plurality of warp yarns were looped around said filler yarns and pile yarns in the backing section and formed a mesh in a second direction. A binder prevented separation of the yarns in the backing section. Official Gazette of the U.S. Patent Office

N78-25351* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLOW COMPENSATING PRESSURE REGULATOR Patent
Edward F. Baehr, inventor (to NASA) Issued 18 Apr. 1978 5 p Filed 21 Mar. 1977 Supersedes N77-20408 (15 - 11, p 1453)
(NASA-Case-LEW-12718-1; US-Patent-4,084,612; US-Patent-Appl-SN-779428; US-Patent-Class-137-484.2; US-Patent-Class-137-501; US-Patent-Class-137-505.16) Avail: US Patent Office CSCL 20D

An apparatus for regulating pressure of treatment fluid during ophthalmic procedures is described. Flow sensing and pressure regulating diaphragms are used to modulate a flow control valve. The pressure regulating diaphragm is connected to the flow control valve to urge the valve to an open position due to pressure being applied to the diaphragm by bias means such as a spring. The flow sensing diaphragm is mechanically connected to the flow control valve and urges it to an opened position because of the differential pressure on the diaphragm generated by a flow of incoming treatment fluid through an orifice in the diaphragm. A bypass connection with a variable restriction is connected in parallel relationship to the orifice to provide for adjusting the sensitivity of the flow sensing diaphragm. A multiple lever linkage system is utilized between the center of the second diaphragm and the flow control valve to multiply the force applied to the valve by the other diaphragm and reverse the direction of the force. Official Gazette of the U.S. Patent Office

N78-25352 Ecole Polytechnique Federale de Lausanne (Switzerland). Inst. de Thermique Appliquee.
INTRODUCTION BETWEEN AN OBLIQUE SHOCK WAVE AND A SUBSONIC STATOR CASCADE (CONTRIBUTION TO THE STUDY OF UNSTEADY WAVE PROPAGATION IN A SUPERSONIC COMPRESSOR STAGE)
Daniel Favrat Zurich Juris-Verlag 1976 183 p refs In FRENCH; ENGLISH summary Sponsored by Brown, Boveri Cie. AG, Baden
(EPFL-ITA-4; ISBN-3-260-04232-6) Avail: Juris-Verlag Sw. Fr. 16

A theoretical and experimental study is presented of the interaction between a uniform oblique shock wave and a subsonic vanes cascade, and allowing the estimation of the main consequences in a complete stage. The pressure and velocity fields surrounding an isolated idealized vane are determined theoretically by using the pseudostationary character of the waves' deformation around each extremity of the vane. The importance of the cascade effect is evaluated. An experimental investigation, with schlieren photographs taken in the shock tube, illustrates successively the interaction between an oblique shock and (1) a vane without flow, (2) a vane with subsonic flow, (3) a stator cascade with subsonic flow. The oblique shock and the flow are generated by the same relatively strong shock wave which is partly reflected on an oblique porous wall. The agreement with the theory is good and it is shown that a shock wave through a cascade is, in general, schematically divided into two main wave fronts connected by auxiliary waves. Author (ESA)

N78-25353 Ernst-Mach-Inst., Freiburg (West Germany).
SHOCK WAVE PRESSURES IN A TUBE WITH BIFURCATIONS BETWEEN 30 deg AND 150 deg [STOSSWELLENDRUECKE IN EINEM ROHR MIT ABZWEIGUNGEN ZWISCHEN 30 GRAD UND 150 GRAD]
H. P. Mehlin and M. Froboese Apr. 1977 43 p refs In GERMAN; ENGLISH summary
(Rept-3/77) Avail: Issuing Activity

In a detonation shock tube (29 cm internal diameter) with a bifurcation side tube of same cross section the shock wave propagation of detonating Hexolite rods (d = 15-30 mm) was investigated. The branching angle alpha varied between 30 and 150 deg. Out of pressure time records obtained at different initial intensities the maximum pressures in the main and side tubes were determined as a function of alpha. By interpolation the wave attenuations at the branching for certain nominal pressures (15, 25, 35 bar) were evaluated as a function of the angle and distance, i.e., max 50 m in the main tube and 20 m in the side tube. The attenuation in the main tube depends only slightly on the nominal pressure and angle; in the side tube the influence of the nominal pressure on attenuation is small; of the angle, however, considerable. The ratio of the pressure in the main tube to the one in the side tube at equidistant positions of the tube branching increases approximately from 1 to 3 in the range of 30 to about 120 deg. With increasing angles alpha approx. 120 to 150 deg this ratio decreases again.Author (ESA)

N78-25354*# Universal Systems, Inc., Arlington, Va.
EVALUATION OF THE OBLIQUE DETONATION WAVE RAMJET Final Report, Jan. - Sep. 1977
Richard B. Morrison Jan. 1978 85 p refs
(Contract NAS1-14771)
(NASA-CR-145358) Avail: NTIS HC A05/MF A01 CSCL 20D

The potential performance of oblique detonation wave ramjets is analyzed in terms of multishock diffusion, oblique detonation waves, and heat release. Results are presented in terms of thrust coefficients and specific impulses for a range of flight Mach numbers of 6 to 16. Author

N78-25355*# General Applied Science Labs., Inc., Westbury, N. Y.
SHOCK CAPTURING FINITE-DIFFERENCE AND CHARACTERISTIC REFERENCE PLANE TECHNIQUES FOR THE PREDICTION OF THREE-DIMENSIONAL NOZZLE-EXHAUST FLOWFIELDS
S. Dash and P. DelGuidice May 1978 153 p refs
(Contract NAS1-12726)
(NASA-CR-145366) Avail: NTIS HC A08/MF A01 CSCL 20D

This report summarizes work accomplished under Contract No. NAS1-12726 towards the development of computational procedures and associated numerical. The flow fields considered were those associated with airbreathing hypersonic aircraft which require a high degree of engine/airframe integration in order to achieve optimized performance. The exhaust flow, due to physical area limitations, was generally underexpanded at the nozzle exit; the vehicle afterbody undersurface was used to provide additional expansion to obtain maximum propulsive efficiency. This resulted in a three dimensional nozzle flow, initialized at the combustor exit, whose boundaries are internally defined by the undersurface, cowling and walls separating individual modules, and externally, by the undersurface and slipstream separating the exhaust flow and external stream. Author

N78-25356# National Aerospace Lab., Tokyo (Japan).
A UNIFIED MEAN VELOCITY PROFILE FAMILY TO LAMINAR, TRANSITION AND TURBULENT BOUNDARY LAYERS AND TURBULENT WAKE
Yoji Ishida Jan. 1978 37 p refs In JAPANESE; ENGLISH summary
(NAL-TR-523) Avail: NTIS HC A03/MF A01

A new unified velocity profile family is proposed which is valid to laminar, transition and turbulent boundary layers as well as turbulent wake. The profile family is based on a quasi-universal velocity defect law, the similarity law for mean velocity fields observed from a frame of reference moving with the speed of Um(the mean velocity at y = 0.45 delta). The profile family nominally possesses six characteristic parameters. However, good empirical correlations exist for some of them, which can reduce the number of parameters. Particular usefulness for integral calculation methods is expected. A similarity law for turbulent shear stress distribution in fully developed turbulent shear layers is also proposed. Author

N78-25357# National Aerospace Lab., Tokyo (Japan).
A CALCULATION METHOD FOR TWO-DIMENSIONAL INCOMPRESSIBLE TURBULENT BOUNDARY LAYERS: APPLICATION OF THE UNIFIED VELOCITY PROFILE FAMILY

Yoji Ishida Jan. 1978 13 p refs In JAPANESE; ENGLISH summary
(NAL-TR-524) Avail: NTIS HC A02/MF A01

The unified velocity profile family is applied to the integral method of calculation for two-dimensional incompressible turbulent boundary layers. The six unknown parameters contained in the family are reduced to three by two empirical relations obtained from experimental data and Thompson's skin friction law. Momentum integral, energy integral and moment-of-momentum integral equations are used to determine the three parameters. The method has been successfully tested for the boundary layers with various external pressure gradients. Author

N78-25358*# Wisconsin-Milwaukee Univ., Milwaukee.
COMPUTATIONAL FLOW DEVELOPMENT FOR UNSTEADY VISCOUS FLOWS: FOUNDATION OF THE NUMERICAL METHOD Progress Report
Theodore Bratanow and Thomas Spehert May 1978 40 p refs
(Grant NGR-50-007-001)
(NASA-CR-2995) Avail: NTIS HC A03/MF A01 CSCL 20D

A procedure is presented for effective consideration of viscous effects in computational development of high Reynolds number flows. The procedure is based on the interpretation of the Navier-Stokes equations as vorticity transport equations. The physics of the flow was represented in a form suitable for numerical analysis. Lighthill's concept for flow development for computational purposes was adapted. The vorticity transport equations were cast in a form convenient for computation. A statement for these equations was written using the method of weighted residuals and applying the Galerkin criterion. An integral representation of the induced velocity was applied on the basis of the Biot-Savart law. Distribution of new vorticity, produced at wing surfaces over small computational time intervals, was assumed to be confined to a thin region around the wing surfaces. Author

N78-25359*# Aeronautical Research Associates of Princeton, Inc., N. J.
APPLICATION OF SECOND-ORDER TURBULENT MODELING TO THE PREDICTION OF RADIATED AERODYNAMIC SOUND
Alan J. Bilanin and Joel E. Hirsh Jun. 1978 76 p refs
(Contract NAS2-8832)
(NASA-CR-2994) Avail: NTIS HC A05/MF A01 CSCL 20D

The Ribner formulation of the generation of aerodynamic sound is coupled with predictions of second-order velocity correlations and integral scale to estimate the sound radiated from several complicated jet flows. In particular, it is shown that the sound radiated from a cold swirling jet is greater than from its nonswirling equal thrust counterpart. The noise radiated from the flow field of a multitube suppressor was estimated and compared with an equal thrust diameter Gaussian jet. It is shown that the multitube concept is indeed quieter. Author

N78-25360# European Space Agency, Paris (France).
LA RECHERCHE AEROSPATIALE. BI-MONTHLY BULLETIN NO. 1977-6
Max Salmon, ed. May 1978 137 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-6, Nov.-Dec. 1977 p 327-376 Original French report available from ONERA, Paris FF 30
(ESA-TT-476) Avail: NTIS HC A07/MF A01

The following topics are presented: streamlines in a steady flow with separation, shock wave/turbulent boundary layer transition, viscous/inviscid flow matching, calculation of two-dimensional or axisymmetric supersonic flow by a finite difference method, aerodynamic noise origin, and determination of the critical stress intensity factor of aluminum alloys from low-cycle fatigue tests on notched specimens. For individual titles, see N78-25361 through N78-25366.

N78-25361 European Space Agency, Paris (France).
STREAMLINES IN A STEADY FLOW. SEPARATION AND DIVISION
Robert Legendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-6 (ESA-TT-476) May 1978 p 1-30 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-6, Nov.-Dec. 1977 p 327-335 Original report in FRENCH previously announced as A78-23921 (For availability see N78-25360 16-34)
HC A07/MF A01

Consideration is given to the behavior of streamlines in two-dimensional flows, noting plane and axisymmetric flows, parietal flow over an obstacle or a current surface, and conical flows projected onto a plane or a sphere. Separation lines in two-dimensional flows are discussed and the behavior of streamlines in three-dimensional flows is also described with reference to the separation surface in such cases. Mathematical singularities are used for studying regular vector fields.
Author (ESA)

N78-25362 European Space Agency, Paris (France).
RESEARCH ON SHOCK WAVE - TURBULENT BOUNDARY LAYER INTERACTION
Jean Delery *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-6 (ESA-TT-476) May 1978 p 31-61 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-6, Nov.-Dec. 1977 p 337-348 Presented at the 13th Appl. Aerodyn. Colloq., Lyon, 8-10 Nov. 1976; sponsored by AAAF Original report in FRENCH previously announced as N77-32449 (For availability see N78-25360 16-34)
HC A07/MF A01

Interaction phenomena between shock waves and turbulent boundary layers are of major importance in transonic flow. It is essential to take them into account in order to obtain a correct prediction of the lift of an airfoil. Coupling methods which exist at present to solve this problem depend on an accurate description of the behavior of the boundary layer across a shock. It is thus still necessary to rely largely on experiment. Research at ONERA covers a wide range of Reynolds numbers. Using various measurement techniques, it has been possible to obtain detailed information on the development of a boundary layer under the influence of increasingly strong shocks (up to the approach of separation). The systematic examination of the results has led to the development of a semi-empirical method which gives a fairly good representation of the thickening of the boundary layer during the interaction. Author (ESA)

N78-25363 European Space Agency, Paris (France).
VISCOUS-INVISCID FLOW MATCHING: ANALYSIS OF THE PROBLEM INCLUDING SEPARATION AND SHOCK WAVES
Jean-Claude LeBalleur *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-6 (ESA-TT-476) May 1978 p 62-91 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-6, Nov.-Dec. 1977 p 349-358 Presented at the Workshop on Viscous Interaction and Boundary Layer Separation, Columbus, Ohio, 16-17 Aug. 1976 Original report in FRENCH previously announced as A78-23922 (For availability see N78-25360 16-34)
HC A07/MF A01

The tangency condition of ideal fluid calculations is replaced by a condition of strong coupling to the boundary layer. The implications of the Prandtl equation are discussed, especially those of their integral form, in case of separation. The necessary downstream boundary conditions were analyzed, as well as the transmission of their influence upstream in supersonic flow. It is shown that a matching by source distribution at the wall eliminates the supercritical interactions as defined by Crocco-Lee and takes into account the shock wave penetration into turbulent boundary layers. Author (ESA)

N78-25364 European Space Agency, Paris (France).
CALCULATION OF TWO-DIMENSIONAL OR AXISYMMETRIC SUPERSONIC FLOWS BY A FINITE DIFFERENCE METHOD
Pierre Diringer *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-6 (ESA-TT-476) May 1978 p 92-115 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-6, Nov.-Dec. 1977 p 359-368 Original report in FRENCH previously announced as A78-23923 (For availability see N78-25360 16-34)
HC A07/MF A01

MacCormack's finite difference scheme was used to resolve

Eulerian equations in the case of flows between walls. It is sought here, by means of realistic examples, to see how far this scheme can be fitted to take into account several discontinuities which may occur in such flows: discontinuity of wall curvature, shock waves with reflection on the axis for an ideal gas, and discontinuity of temperature gradient in the case of a propellant. For this, two FORTRAN programs were set up for axisymmetric nozzles: one for the ideal gas, the other for the propellant. These questions are satisfactorily answered as regards accuracy, flexibility, and calculation time. Some reservations are laid down in the case of Prandtl-Meyer expansions.
Author (ESA)

N78-25365 European Space Agency, Paris (France).
NOISE OF AERODYNAMIC ORIGIN. DISCUSSION OF VARIOUS APPROACHES
Robert Legendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-6 (ESA-TT-476) May 1978 p 116-124 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-6, Nov.-Dec. 1977 p 369-371 Original report in FRENCH previously announced as A78-23924 (For availability see N78-25360 16-34)
HC A07/MF A01

Various theories concerning aerodynamic noise are reviewed. The first of these, that of Doak (1973), is concerned with the mathematical analysis of sound internally generated in continuous media. The second, that of Yates and Sandri, deals with general equations used to describe the concept of Bernouilli enthalpy. The third, that of Legendre (1977), concerns an alternate process of enthalpy integration. It assumes a domain of uniform flow altered only by acoustic waves. The conditions under which the theories may be applied are outlined. Author (ESA)

N78-25366 European Space Agency, Paris (France).
DETERMINATION OF THE CRITICAL STRESS INTENSITY FACTOR OF ALUMINIUM ALLOYS FROM LOW-CYCLE FATIGUE TESTS ON NOTCHED SPECIMENS
Georges Vidal and Guy Ramusat *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-6 (ESA-TT-476) May 1978 p 125-133 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-6, Nov.-Dec. 1977 p 373-376 Original report in FRENCH previously announced as A78-23925 (For availability see N78-25360 16-34)
HC A07/MF A01

The stress intensity factor of 28 aluminum alloys was determined. These fatigue tests, with constant extreme loads, employed undulating tension loads and alternating symmetric tension-compression loads on the same type of notched specimen. Test results are summarized by giving, for each alloy, the mean true stress at rupture with a fatigue notch, the three mean values of the critical stress intensity factor as obtained from three different equations, and the standard deviation of these values. It is shown that it is possible to validly measure the critical stress intensity factor of aluminum alloys from the results of low cycle fatigue tests on cylindrical specimens with a circular circumferential notch. ESA

N78-25367# Ohio State Univ. Research Foundation, Columbus.
FLUID DYNAMIC INTERACTIONS IN MULTIPLE NOZZLE ARRAYS Final Report, May 1973 - 30 Sep. 1977
Stuart L. Petrie 20 Mar. 1978 32 p refs
(Grant AF-AFOSR-2537-73; AF Proj. 2307)
(AD-A052591; OSURF-3670; AFOSR-78-0690TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

Theoretical and experimental analyses have been conducted to examine both the steady-state and time-resolved characteristics of the mixing region between two coplanar, two-dimensional supersonic nozzles. In addition, an electron beam generator and associated optical measuring system have been assembled for use in CO2 gas dynamic laser systems at the Air Force Weapons Laboratory. Author (GRA)

N78-25368# Harvard Univ., Cambridge, Mass. Div. of Applied Sciences.
FLUID MECHANICS RESEARCH Final Technical Report, 1 Jul. 1971 - 30 Jun. 1974
George F. Carrier and Frederick H. Abernathy Apr. 1978 40 p refs
(Contract N00014-67-A-0298)
(AD-A053054) Avail: NTIS HC A03/MF A01 CSCL 20/4

Several studies on geophysical fluid mechanical phenomena and two on diffusion flames are reported. Other ongoing but unfinished studies are listed. Experimental investigations of laminar and turbulent boundary layer flows with polymers are reported. The existence of a family of velocity fluctuations distinct from turbulence is documented. Author (GRA)

N78-25369# RAND Corp., Santa Monica, Calif.
THE COMBINED EFFECTS OF PRESSURE GRADIENT AND HEATING ON THE STABILITY AND TRANSITION OF BOUNDARY LAYERS IN WATER Interim Report
A. R. Wazzan and Carl Gazley, Jr. Mar. 1978 46 p refs
(Contract MDA903-78-C-0121; ARPA Order 3486)
(AD-A053084; RAND/R-2175-ARPA) Avail: NTIS HC A03/MF A01 CSCL 20/4

Appreciable drag reduction is possible if extended regions of laminar flow can be maintained. Although a variety of techniques for boundary-layer control have been explored, only recently has the powerful effect of heat transfer on the stability and transition of water boundary layers been realized. This report presents computational results for the stability and predicted transition characteristics of water boundary-layer 'wedge' flows for various combinations of pressure gradient and heat transfer. Both the minimum critical Reynolds number and the predicted transition Reynolds number of these 'similar' boundary layers increase as surface temperature increases above the ambient level. The interacting effects of pressure gradient and surface heating on stability and predicted transition may be approximately characterized by a boundary-layer shape parameter. To maintain an extended region of laminar flow, the boundary-layer development should follow a path in which the shape parameter is kept as low as possible over as great a range of Reynolds number as possible. GRA

N78-25370# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
HYDRAULIC SIGNAL-PROCESSING AMPLIFIER PERFORMANCE IN POSITION CONTROL SYSTEMS
David Lee and David N. Wormley Dec. 1977 44 p
(Contract DAAG29-74-C-0191; DA Proj. 1T1-61102-A-33B)
(AD-A053030; HDL-CR-77-191-1) Avail: NTIS HC A03/MF A01 CSCL 13/7

Summing and proportional gain amplifiers for use in hydraulic closed-loop position control systems have been developed and their static and dynamic characteristics measured. Amplifiers constructed using a laminar flow laminate design with 0.5 mm nozzle width and an aspect ratio of 2.0 exhibited frequency responses with less than 3 db decay and 90 deg phase shift at 300 Hz when operated at 110 kPa supply pressure. A closed-loop position control system for a load mass has been developed and tested using the summing and proportional gain amplifier, a position-to-fluid pressure feedback transducer, a hydraulic actuator, and a two-stage commercial servovalve modified to accept fluid inputs. Tests performed on the servosystem demonstrated a response to position step command, with no overshoot, in 38 ms. Analysis and test data show that the primary element limiting dynamic response is the fluidic input servovalve. GRA

N78-25371# RAND Corp., Santa Monica, Calif.
SIMPLE RELATIONS FOR THE STABILITY OF HEATED LAMINAR BOUNDARY LAYERS IN WATER: MODIFIED DUNN-LIN METHOD Interim Report
J. Aroesty, W. S. King, G. M. Harpole, W. Matyskiela, and A. R. Wazzan Mar. 1978 27 p refs
(Contract MDA903-78-C-0121; ARPA Order 3486)
(AD-A053068; RAND/R-2209-ARPA) Avail: NTIS HC A03/MF A01 CSCL 20/4

A simplified method for calculating the effect of surface heating on the hydrodynamic stability of heated laminar boundary layers in water is presented. The method involves modification and updating of relations first developed by Lin for a constant property fluid and later by Dunn and Lin for a compressible one. These modified Dunn-Lin relations for the minimum critical Reynolds number give results in substantial agreement with numerical integration of the Orr-Sommerfeld equations. The powerful effects of surface temperature distribution on the stability

of laminar boundary layers in water are illustrated, even for adverse pressure gradient. Author (GRA)

N78-25372# ARO, Inc., Arnold Air Force Station, Tenn.
INTEGRAL ANALYSIS OF DUCTED TWO-STREAM MIXING WITH RECIRCULATION Final Report, 1 Oct. 1976 - 30 Sep. 1977
C. E. Peters and W. J. Phares AEDC Mar. 1978 72 p refs Sponsored by the AF
(AD-A053053; AEDC-TR-77-115) Avail: NTIS HC A04/MF A01 CSCL 20/4

The integral boundary-layer equations are used to develop an analysis of ducted turbulent mixing of coaxial streams. Non-recirculating flows, as well as flows with a recirculation region along the duct wall, are considered in the formulation. The flow geometry considered is either axisymmetric or planar, and a provision is made to calculate flows with a centerbody. Chemical reactions in the mixing process, if they occur, are assumed to be in equilibrium. A simple eddy viscosity model is used to describe the turbulent transport processes. Comparison of the analytical results with experiments indicates that the location and extent of recirculation are well predicted, at least for flows with moderate density gradients. However, because of the neglect of streamwise turbulent transport processes in the analysis, the predicted concentration field in recirculating flow is in only fair agreement with the experiment. An extended integral analysis, in which the streamwise turbulent transport of momentum and species is included in an approximate manner, is formulated. Author (GRA)

N78-25373# New York Univ., Westbury. Aerospace and Energetics Lab
FLUID DYNAMICS OF A FLUIDIZED BED PACKED WITH HEAT EXCHANGERS Interim Report, Feb. - May 1977
V. Zakkay, S. Panunzio, A. Brentan, and G. Miller May 1977 36 p
(Contract EX-76-C-01-2256)
(FE-2256-5) Avail: NTIS HC A03/MF A01

The experimental work performed during the period covered by the present progress report focused on the three following areas: (1) investigation of the effects of the position of the heat exchanger and of the relative bed depth on the overall heat transfer coefficient; (2) generation of a comprehensive set of experimental data concerning the effect of the operating pressure on the heat transfer performance of the bed; and (3) the structural behavior of the fluidized bed at various operating pressures was studied. ERA

N78-25374# General Atomic Co., San Diego, Calif.
US/FRG JOINT PEBBLE BED REACTOR EVALUATION Final Report, fiscal year 1977
Oct. 1977 217 p refs
(Contract EY-76-C-03-0167-061)
(GA-A-14611) Avail: NTIS HC A10/MF A01

The scope of the program was to develop technical, economic, and program information in support of decisions and planning by DOE regarding thermal gas-cooled reactor (TGR) development in the U.S. and cooperative international TGR programs. Particular emphasis was placed on technical review of the large pebble bed high-temperature gas-cooled reactor (HTR) concept. A matrix of decision input information was prepared. This information is summarized in this report and includes comparison information for selected energy alternatives. A review of the prestressed cast iron pressure vessel (PCIV) concept is reported along with safety and licensing considerations for potential U.S. licensing. ERA

N78-25375# Sandia Labs., Albuquerque, N. Mex.
EULERIAN FINITE-DIFFERENCE CALCULATIONS OF EXPLOSIONS IN PARTIALLY WATER-FILLED OVERSTRONG CYLINDRICAL CONTAINMENT VESSELS
S. L. Thompson and W. Hermann 1977 145 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1342) Avail: NTIS HC A07/MF A01

Calculations, using the two dimensional Eulerian finite difference code CSQ, were performed for the problem of a small spherical high explosive charge detonated in a closed heavy walled cylindrical container partially filled with water. Data from corresponding experiments, specifically performed to validate codes used for hypothetical core disruptive accidents of liquid metal fast breeder reactors, are presented. The calculations were performed specifically to test whether Eulerian methods could handle this type of problem, to determine whether water cavitation, which plays a large role in the loading on the roof of the containment vessel, could be described adequately by an equilibrium liquid vapor mixed phase model, and to investigate the trade-off between accuracy and cost of the calculations by using different sizes of computational meshes. Comparison of the experimental and computational data shows that the Eulerian method can handle the problem with ease, giving good predictions of wall and floor loadings. While roof loadings are qualitatively correct, peak impulse appears to be affected by numerical resolution and is underestimated. ERA

N78-25376# Battelle Columbus Labs., Ohio.
STUDY OF HEAT TRANSFER THROUGH REFRACTORY LINED GASIFIER VESSEL WALLS Quarterly Progress Report, Jun. - Aug. 1977
J. R. Schorr Aug. 1977 48 p refs
(Contract EX-76-C-01-2210)
(FE-2210-20) Avail: NTIS HC A03/MF A01

The objective of this program is to develop an empirically derived computer model suitable for use by the vessel designer to determine heat flow through multicomponent, refractory-lined gasifier vessel walls, so that the effects of parameters such as lining thickness, density, refractory composition, physical form, metal anchor spacing and configuration, and gas pressure and composition can be predicted. The program includes the design, construction, and operation of test apparatus for evaluating the parameters which influence heat flow through refractory lining materials. ERA

N78-25377# Sea Solar Power, Inc., York, Pa.
COMPACT HEAT EXCHANGERS FOR SEA THERMAL POWER PLANTS Technical Status Report No. 1
J. H. Anderson 1 Aug. 1977 16 p refs
(Contract EG-77-C-02-4300)
(TID-28151) Avail: NTIS HC A02/MF A01

Heat exchangers for use with ammonia and sea water were developed. While it is obvious that the heat exchangers should have high heat transfer coefficients, the basic objective is to get the greatest amount of thermal units transferred from sea water to boiling ammonia at the lowest cost for a given mean temperature difference. A design study directed toward heat exchangers constructed of flat plates with various possible constructions for the ammonia passages and the water passages is presented. ERA

N78-25378# Sandia Labs., Albuquerque, N. Mex. Fluid Mechanics and Heat Transfer Div.
COMPUTATIONAL AND EXPERIMENTAL METHODS FOR ENCLOSED NATURAL CONVECTION
D. W. Larson, David K. Gartling, and Walter P. Schimmel Oct. 1977 44 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0645) Avail: NTIS HC A03/MF A01

Two computational procedures and one optical experimental procedure for studying enclosed natural convection are described. Finite-difference and finite-element numerical methods were developed and several sample problems were solved. Results obtained from the two computational approaches are compared. A temperature-visualization scheme using laser holographic interferometry is described, and results from this experimental procedure are compared with results from both numerical methods. ERA

N78-25379# Oak Ridge National Lab., Tenn.
MONTE CARLO METHOD OF SOLVING HEAT CONDUCTION PROBLEMS Ph.D. Thesis - Tennessee Univ.
S. K. Fraley, T. J. Hoffman, and P. N. Stevens (Tennessee Univ.) Dec. 1977 171 p refs
(Contract W-7405-eng-26)
(ORNL/NUREG/CSD-3) Avail: NTIS HC A08/MF A01

An innovative approach in the use of Monte Carlo to solve heat conduction problems was developed using a transport equation approximation to the heat conduction equation. The

method was shown to be applicable to the solution of multimedia problems in complex geometries with no inherent limitations as to the geometric complexity of problems which can be solved. Nuclear radiation transport and heat conduction problems were calculated with the same computer code. In the case where the nuclear reactions are the heat source, the problem was performed in a coupled mode with a single computer run. The method was demonstrated for problems involving multimedia, internal sources, fixed temperature boundary conditions, convective boundary conditions, time dependent sources, and for a coupled nuclear radiation heat conduction problem. Comparisons were made to analytical solutions when they were available or could be generated. ERA

N78-25380# Argonne National Lab., Ill.
SURVEY OF NUMERICAL METHODS FOR HYDRAULIC TRANSIENTS
G. K. Leaf and T. C. Chawla Oct. 1977 80 p refs
(Contract W-31-109-eng-38)
(ANL-77-81) Avail: NTIS HC A05/MF A01

The finite difference methods of Lax, Lax-Wendroff, donor cell type, and finite element method using Galerkin procedure with B-splines as approximating functions were compared with the method of characteristics for the solution of water hammer transients as typified by valve closure problems. From the point of view of accuracy, the two step Lax-Wendroff method and the method of characteristics are comparable and produce the best results. The donor cell type and the Galerkin procedure with quadratic B-spline basis as approximating functions display roughly the same accuracy. From the comparison presented, it appears that Galerkin technique offers no substantial advantage over the other finite difference methods except that of ease in handling boundary conditions as compared to finite difference methods. ERA

N78-25381# Massachusetts Inst. of Tech., Oak Ridge, Tenn. School of Chemical Engineering Practice.
DISPERSION OF MISCIBLE FLUID IN POROUS MEDIA
S. S. Moor, S. J. Anderson, B. A. Belt, and J. P. McAleese 19 Oct. 1977 27 p refs
(Contract W-7405-eng-26)
(ORNL/MIT-259) Avail: NTIS HC A03/MF A01

The effect of particle diameter, density difference, and fluid flow rate on the stability of miscible displacements was investigated using ethanol and water solutions in a 50-cm x 2.54-cm-ID column packed with spherical glass beads. The flow characteristics were adequately described by a modified dispersion model that involves the dispersion coefficient, D, and the fraction of the bed that was active, f. ERA

N78-25382# National Technical Information Service, Springfield, Va.
HEAT PIPES, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1974 - Mar. 1977
William E. Reed Mar. 1978 225 p
(NTIS/PS-78/0303) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 20D

Research reports covering the thermodynamics, design, fabrication, and applications of heat pipes are cited from worldwide literature. Applications are described in the areas of electronics cooling, spacecraft thermal control, heat exchangers, heating and refrigeration, and waste heat utilization. This updated bibliography contains 216 abstracts, none of which is a new entry to the previous edition. Author

N78-25383# National Technical Information Service, Springfield, Va.
HEAT PIPES, VOLUME 3. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Apr. 1977 - Mar. 1978
William E. Reed Mar. 1978 140 p Supersedes NTIS/PS-77/0276; NTIS/PS-76/0251
(NTIS/PS-78/0304; NTIS/PS-77/0276; NTIS/PS-76/0251) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 20D

Research reports covering the thermodynamics, design, fabrication, and applications of heat pipes are cited from worldwide literature. Applications are described in the areas of electronics cooling, spacecraft thermal control, heat exchangers, heating and refrigeration, and waste heat utilization. This updated bibliography contains 131 abstracts, all of which are new entries to the previous edition. Author

N78-25384# National Technical Information Service, Springfield, Va.
HEAT PIPES, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, Mar. 1976 - Mar. 1978
William E. Reed Mar. 1978 177 p Supersedes NTIS/PS-77/0275; NTIS/PS-76/0249; NTIS/PS-75/317
(NTIS/PS-78/0302; NTIS/PS-77/0275; NTIS/PS-76/0249; NTIS/PS-75/317) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 20D

The theory, design, fabrication, testing, and operation of heat pipes are discussed in these federally-sponsored research reports. Applications are described in the areas of heating and air conditioning power generation, electronics cooling, spacecraft, nuclear reactors, cooling engines, and thermodynamics. This updated bibliography contains 170 abstracts, 83 of which are new entries to the previous edition. Author

N78-25385# National Technical Information Service, Springfield, Va.
CAVITATION. PART 1: CAVITATION FLOW, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1974 - Feb. 1978
Guy E. Habercom, Jr. Mar. 1978 192 p Supersedes NTIS/PS-77/0241; NTIS/PS-76/0164; NTIS/PS-75/292
(NTIS/PS-78/0258; NTIS/PS-77/0241; NTIS/PS-76/0164; NTIS/PS-75/292) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 20D

A bibliography containing 187 reports on general aspects of cavitating flow is presented. A wide range of theoretical, analytical, and experimental information is reported involving mathematical analysis, computer programs and testing. Topics include marine engineering, hydrodynamic and aerodynamic configurations, symmetric and nonaxisymmetric shapes, and measuring technology. Data are given on surface piercing struts, helical inducers, pumps, liquid metal systems, and venturi tubes. Applications include dam outlets and spillways, vertical conduits, deep rock drilling, heat pipe stability, water entry, and liquid cryogenic systems. Flow characteristics, noise, nucleate boiling, perturbation problems, and allied subjects are discussed. Author

N78-25386# National Technical Information Service, Springfield, Va.
CAVITATION. PART 2: HYDROFOILS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1978
Guy E. Habercom, Jr. Mar. 1978 173 p Supersedes NTIS/PS-77/-242; NTIS/PS-76/0165; NTIS/PS-75/293
(NTIS/PS-78/0259; NTIS/PS-77/0242; NTIS/PS-76/0165; NTIS/PS-75/293) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 20D

A bibliography containing 168 abstracts on the cavitation characteristics of various classes of hydrofoils such as fully submerged, ventilated, high speed, supercavitating, and jet flapped was presented. Surface piercing struts were studied. Test facilities, models, and test methods were described. Lift, drag, oscillation, flutter, heaving, hydroelasticity, and loading were discussed. Other topics included entrainment, bubbles, unsteady forces, flow fields, sea states, cavitation noise, mathematical models, and boundary layers, along with investigations of hydrofoil craft performance. Author

N78-25387# National Technical Information Service, Springfield, Va.
CAVITATION. PART 3: CORROSION AND EROSION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1978
Guy E. Habercom, Jr. Mar. 1978 132 p Supersedes NTIS/PS-77/0243; NTIS/PS-76/0166; NTIS/PS-75/294
(NTIS/PS-78/0260; NTIS/PS-77/0243; NTIS/PS-76/0166; NTIS/PS-75/294) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 20D

A bibliography containing 127 abstracts on the corrosion and erosion effects of cavitation is presented. Studies are presented on marine propellers, pumps, dams, and spillways. Space power

systems are included. The discussions refer to bubble and microbubble investigations, concepts and theories of damage, scaling laws, mathematical models, numerical analysis, and computerized simulation. Erosion prevention, hydroabrasive wear, metal and elastomeric surface protection, and raindrop resistance were studied. Other topics include vibration, liquid solid interfaces, viscoelasticity, dissolved and contained gases, and flow fields, such as cryogenic, liquid metal, and multiphase. Test equipment, methods, models, and findings are described. Author

N78-25388# National Technical Information Service, Springfield, Va.
CAVITATION. PART 4: CAVITATION FLOW AND EROSION IN TURBINES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1978
Guy E. Habercom, Jr. Mar. 1978 92 p supersedes NTIS/PS-77/0244; NTIS/PS-76/0167; NTIS/PS-75/295
(NTIS/PS-78/0261; NTIS/PS-77/0244; NTIS/PS-76/0167; NTIS/PS-75/295) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 20D

A bibliography containing 87 abstracts on the cavitation flow characteristics and erosion processes involving turbopumps, turbine blades, and steam turbines is presented. Steam, liquid, and drop flow were investigated. Test facilities and methods are described, as well as statistical and theoretical information. The applications include rocket engines, cryopumps, and other hydraulic turbines. Author

N78-25389# National Technical Information Service, Springfield, Va.
CAVITATION. PART 5: PROPELLER CAVITATION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1978
Guy E. Habercom, Jr. Mar. 1978 120 p Supersedes NTIS/PS-77/0245; NTIS/PS-76/0168; NTIS/PS-75/296
(NTIS/PS-78/0262; NTIS/PS-77/0245; NTIS/PS-76/0168; NTIS/PS-75/296) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 20D

A bibliography containing 115 abstracts on propeller cavitation flow is presented. The topics include controllable pitch propellers, ship propellers of all types, supercavitation, and control systems. Author

N78-25390# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
COUPLED GASDYNAMICS AND KINETICS DURING CONDENSATION IN A RAREFACTION WAVE
David R. Forshey and Welby G. Courtney 1977 22 p refs
(PB-277274; BM-RI-8256) Avail: NTIS HC A02/MF A01 CSCL 20D

A quantitative theoretical analysis is presented of a coupled gasdynamics/heat release system involving the kinetics of water condensation in and behind the rarefaction wave in a shock tube using the method of characteristics. The merger of characteristics to form a shock wave is included. Author

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N78-25391* National Aeronautics and Space Administration. Pasadena Office, Calif.
POLYMERIC ELECTROLYTIC HYGROMETER Patent
Daniel D. Lawson, inventor (to NASA) (JPL) Issued 11 Apr. 1978 5 p Filed 21 Dec. 1976 Sponsored by NASA
(NASA-Case-NPO-13948-1; US-Patent-4,083,765; US-Patent-Appl-SN-752748; US-Patent-Class-204-195W; US-Patent-Class-73-336.5) Avail: US Patent Office CSCL 14B

An improved flow-through electrolytic hygrometer is described which utilizes a long lasting oxidation-resistant, hollow fiber formed from persulfonic acid substituted polytetrafluoroethylene having closely spaced noble metal electrodes in contact with the inner and outer surfaces of the fiber. The fiber is disposed within a chamber so that the moisture-bearing gas passes in contact with at least one surface of the fiber. The electrodes are connected in series to a dc voltage supply and an ammeter. As the gas passes through the chamber, moisture absorbed into the wall of the fiber is electrolyzed to hydrogen and oxygen by the closely spaced electrodes. The amount of electricity required for electrolysis is proportional to the absorbed moisture and is observed on the ammeter.
Official Gazette of the U.S. Patent Office

N78-25392*# Massachusetts Inst. of Tech., Cambridge. Center for Materials Science and Engineering.
CHARGE-FLOW STRUCTURES AS POLYMERIC EARLY-WARNING FIRE ALARM DEVICES M.S. Thesis
Carl M. Sechen and Stephen D. Senturia May 1977 96 p refs
(Grant NsG-3061)
(NASA-CR-157215; TR-1) Avail: NTIS HC A05/MF A01 CSCL 06G

The charge-flow transistor (CFT) and its applications for fire detection and gas sensing were investigated. The utility of various thin film polymers as possible sensing materials was determined. One polymer, PAPA, showed promise as a relative humidity sensor; two others, PFI and PSB, were found to be particularly suitable for fire detection. The behavior of the charge-flow capacitor, which is basically a parallel-plate capacitor with a polymer-filled gap in the metallic tip electrode, was successfully modeled as an RC transmission line. Prototype charge-flow transistors were fabricated and tested. The effective threshold voltage of this metal oxide semiconductor was found to be dependent on whether surface or bulk conduction in the thin film was dominant. Fire tests with a PFI-coated CFT indicate good sensitivity to smouldering fires. Author

N78-25393# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
LONG PATH, VISIBLE AND INFRARED TRANSMISSOMETER: CALIBRATION AND USE M.S. Thesis
Leo Owen Vroombout Oct. 1977 86 p refs
(AF Proj. 2004)
(AD-A052898; AFIT/GEP/PH/77-14) Avail: NTIS HC A05/MF A01 CSCL 14/2

The Barnes Model 14-WP transmissometer is one of the principle optical path calibration instruments of the Air Force Avionics Laboratory's Targeting Systems Characterization Facility. A simple test based on LOWTRAN IIIB was devised to certify system calibration while installed on an eight kilometer optical path. In addition, an optical path anomaly was investigated. Results are discussed and recommendations for additional calibration tests and new procedures are made. Author (GRA)

N78-25394# Argonne National Lab., Ill.
TEMPERATURE-SENSITIVE ORIFICE: A PRE-TEST REPORT
W. S. Flynt, P. A. Howard, and R. D. Carlson Nov. 1977 31 p refs
(Contract W-31-109-eng-38)
(ANL-CT-78-12) Avail: NTIS HC A03/MF A01

A device which is capable of maintaining a nearly constant blanket assembly exit temperature over several LMFBR fuel cycles is currently being investigated by the Components Technology Division of Argonne National Laboratory. This orifice will develop a pressure drop inversely proportional to temperature with the absence of any moving parts. Design and fabrication of a temperature-sensitive orifice scaled for the High Temperature Simulation Loop (HTSL) has also been completed. The proposed location of a prototypic orifice would be in the upper region of a LMFBR blanket assembly. This location is compatible with current LMFBR design. ERA

N78-25395# Civil and Environmental Engineering Development Office, Tyndall AFB, Fla. Detachment 1 ADTC.
EVALUATION OF A BROMINATED RESIN SYSTEM FOR

FERRICYANIDE BLEACH REGENERATION Final Report, Oct. 1974 - Mar. 1975
Dale H. Allen Mar. 1978 35 p
(AD-A053163; CEEDO-TR-77-4) Avail: NTIS HC A03/MF A01 CSCL 14/5

Brominated resins were evaluated in the laboratory for regenerating ferricyanide bleaches from Air Force photoprocessing laboratories. Several resins were tested to determine bromine transfer rates. Results showed the technique is technically feasible but too complicated and hazardous for small photo labs. Author (GRA)

N78-25396# Air Force Geophysics Lab., Hanscom AFB, Mass.
EXCEDE/SWIR ION MASS SPECTROMETER: AN INSTRUMENT DESCRIPTION
Alan D. Bailey 6 Jan. 1978 21 p
(AD-A053162; AFGL-TR-78-0010; AFGL-IP-261) Avail: NTIS HC A02/MF A01 CSCL 14/2

This report presents the positive-ion mass spectrometer that was part of a SWIR rocketborne electron-accelerator experiment. A quadrupole mass filter with a specially designed ion collection configuration is described. Special attention is given to the problem introduced by high positive vehicle potentials which result from the high emission currents of the electron-accelerator. A comprehensive ion mass scanning program is described and important instrument parameters are specified. Typical data is included only to illustrate instrument performance. GRA

N78-25397# Airborne Instruments Lab., Deer Park, N. Y.
IHR (INFRARED HETERODYNE RADIOMETER) FOR LOW ALTITUDE TEMPERATURE PROFILE RETRIEVAL Final Report, Apr. 1976 - Mar. 1978
I. Rubenstein Mar. 1978 57 p refs
(Contract N00014-76-C-0721)
(AD-A053159; AIL-C618-2) Avail: NTIS HC A04/MF A01 CSCL 04/1

A technique for obtaining accurate temperature and humidity profiles with a grazing-angle up-looking radiometer, for the purpose of assessing index of refraction variations in the atmosphere has been investigated. The profiling techniques are based on information retrievals which are obtained from difference-kernel functions generated from pairs of high spectral resolution radiometric channels. Spatially selective information can be generated from such functions with the required accuracy for retrieving temperature and humidity gradients at the lower altitude atmospheric levels. GRA

N78-25398*# Los Alamos Scientific Lab., N. Mex.
CLASS OF NEAR-PERFECT CODED APERTURES
T. M. Cannon and E. E. Fenimore 1977 7 p refs Presented at the Nucl. Sci. Symp., San Francisco, 19 Oct. 1977
(NASA Order S-57094-A; Contract W-7405-eng-36)
(NASA-CR-157217; LA-UR-77-2369; Conf-771023-4) Avail: NTIS HC A02/MF A01 CSCL 14B

Coded aperture imaging of gamma ray sources has long promised an improvement in the sensitivity of various detector systems. The promise has remained largely unfulfilled, however, for either one of two reasons. First, the encoding/decoding method produces artifacts, which even in the absence of quantum noise, restrict the quality of the reconstructed image. This is true of most correlation-type methods. Second, if the decoding procedure is of the deconvolution variety, small terms in the transfer function of the aperture can lead to excessive noise in the reconstructed image. It is proposed to circumvent both of these problems by use of a uniformly redundant array (URA) as the coded aperture in conjunction with a special correlation decoding method. ERA

N78-25399# Brookhaven National Lab., Upton, N. Y.
AVALANCHE LOCALIZATION AND ITS EFFECTS IN PROPORTIONAL COUNTERS
J. Fischer, H. Okuno (Tokyo Univ., Tahanshi), and A. H. Walenta (Heidelberg Univ.) Nov. 1977 7 p refs Presented at the IEEE Nucl. Sci. Symp., San Francisco, 19-21 Oct. 1977 Submitted for publication
(Contract EY-76-C-02-0016)
(BNL-23453; Conf-771023-19) Avail: NTIS HC A02/MF A01

Avalanche development around the anode wire in a gas proportional counter is investigated. In the region of proportional gas amplification, the avalanche is found to be well localized on one side of the anode wire, where the electrons arrive along the field lines from the point of primary ionization. Induced signals on electrodes surrounding the anode wire are used to measure the azimuthal position of the avalanche on the anode wire. Practical applications of the phenomena such as left-right assignment in drift chambers and measurement of the angular direction of the primary ionization electrons drifting towards the anode wire are discussed. ERA

N78-25400# California Univ., Livermore. Lawrence Livermore Lab.
STREAK CAMERA RECORDING OF INTERFEROMETER FRINGES
N. L. Parker and H. H. Chau 14 Jul. 1977 11 p ref
(Contract W-7405-eng-48)
(UCID-17531) Avail: NTIS HC A02/MF A01

The use of an electronic high-speed camera in the streaking mode to record interference fringe motion from a velocity interferometer is discussed. Advantages of this method over the photomultiplier tube-oscilloscope approach are delineated. Performance testing and data for the electronic streak camera are discussed. The velocity profile of a mylar flyer accelerated by an electrically exploded bridge, and the jump-off velocity of metal targets struck by these mylar flyers are measured in the camera tests. Advantages of the streak camera include portability, low cost, ease of operation and maintenance, simplified interferometer optics, and rapid data analysis. ERA

N78-25401# California Univ., Livermore. Lawrence Livermore Lab.
MULTI-CHANNEL NEUTRAL ANALYZER-SYSTEM
W. E. Nexsen, Jr., W. C. Turner, and W. F. Cummins 14 Sep. 1977 29 p refs
(Contract W-7405-eng-48)
(UCID-17584) Avail: NTIS HC A03/MF A01

Design and calibration of a 15 channel multi-channel analyzer for analysis of energetic neutral particles escaping a hot plasma are discussed. Features of the analyzer include a frequency response from DC to 50 Khz, spatial resolution, mass resolution, and data acquisition and processing for 15 points on the energy distribution that is simultaneously recorded. Another feature of the system is the ability to radially scan the plasma. An rf ion source is used to provide ions and neutrals used for calibration of a reference single channel analyzer. This analyzer is, in turn, used to calibrate the multi-channel analyzer over the energy range 500 eV to 40 keV. A brief description of the data processing system is included. ERA

N78-25402# Sandia Labs., Albuquerque, N. Mex.
DIGITAL SLIFER RECORDER, MODEL A
D. R. Breding, D. Fogel, J. J. Loukota, G. S. Worthen, and J. P. Watterberg Nov. 1977 85 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0930) Avail: NTIS HC A05/MF A01

The digital SLIFER recorder (DSR) is an instrument that records a time varying frequency signal in the range from 700 kHz to 1500 kHz with an amplitude greater tha 200 mV. The signal is referenced to an input fiducial marker, and recording is initiated by an increase in the frequency of the signal. The primary purpose of this instrument is to record data from the SLIFER system. The DSR records 512 samples after the record trigger signal, with a sample interval of 50 microsecond. The measurement essentially uses a 20 cycle period averaging counter techniques. ERA

N78-25403# Argonne National Lab., Ill.
DESIGN STUDY OF A TIME OF FLIGHT SMALL-ANGLE DIFFRACTOMETER FOR A PULSED NEUTRON SOURCE
J. M. Carpenter and J. Faber, Jr. 1977 22 p refs Presented at 4th Intern. Conf. on Small Angle Scattering of Neutrons and X-rays, Gatlinburg, Tenn., 1 Oct. 1977
(Contract W-7405-eng-38)
(CONF-771077-4) Avail: NTIS HC A02/MF A01

The design study for a neutron SAS instrument indicates that an effective high resolution TOF SAS diffractometer can be constructed. The design features include a converging slit

collimator, provision for 5 x 5 sq cm sample cross sectional area, and a 1 x 1 sq m two dimensional detector. The fractional wavelength resolution of the instrument is negligibly small for all wavelengths. The resolution was computed by Monte Carlo simulation and is constant over most of the Q range. A special feature of the instrument is the wide range of accessible Q's, without the requirement of instrument configurational changes. The flux on sample exceeds that at conventional reactor instruments of comparable resolution. ERA

N78-25404# Du Pont de Nemours (E. I.) and Co., Aiken, S. C.
X-RAY FLUORESCENCE SPECTROMETERS: A COMPARISON OF WAVELENGTH AND ENERGY DISPERSIVE INSTRUMENTS
R. V. Slates Nov. 1977 21 p refs
(Contract EY-76-C-09-0001)
(DP-1462) Avail: NTIS HC A02/MF A01

Wavelength dispersive and energy dispersive X-ray fluorescence spectrometers are compared. Separate sections are devoted to principles of operation, sample excitation, spectral resolution, and X-ray detection. Tabulated data from the literature are cited in the comparison of accuracy, precision, and detection limits. Spectral interferences and distortions are discussed. Advantages and limitations are listed for simultaneous wavelength dispersive spectrometers, sequential wavelength dispersive spectrometers, and Si(Li) energy dispersive spectrometers. Accuracy, precision, and detection limits are generally superior for wavelength dispersive spectrometers. ERA

N78-25405# Stanford Linear Accelerator Center, Calif.
X-RAY HOLOGRAPHY GENERATED WITH ELECTRON STORAGE RINGS
P. L. Csonka 1977 34 p refs Prepared in cooperation with Oregon Univ., Eugene
(Contract EY-76-S-06-2230-004)
(RLO/2230/T4-193) Avail: NTIS HC A03/MF A01

It would be possible to make X-ray holograms of small objects, using synchrotron radiation generated by energetic electron beams at appropriately selected (preferably more than one, simultaneous) points from a storage ring. The interference pattern of two waves, both of wavelength lambda, can be recorded near the object on a plate with spatial resolution greater than lambda, provided that the waves approach the plate at grazing angles. A suitable array of many plates may be used simultaneously. Described is a configuration and optics adapted to small detail holography on small objects with radiation from storage rings. The holograms may be enlarged, transcribed on a single plate and viewed in visible light with conventional optical instruments (including the human eye). ERA

N78-25406# National Bureau of Standards, Washington, D. C. Center for Fire Research.
AN INSTRUMENT TO EVALUATE INSTALLED SMOKE DETECTORS Final Report
Thomas G. K. Lee Feb. 1978 39 p refs
(PB-278633/3; NBSIR-78-1430) Avail: NTIS HC A03/MF A01 CSCL 14B

A portable instrument was constructed to test the sensitivity response of installed fire smoke detectors. The test stream consists of impactor-selected small particles from aerosol generated by a pneumatic nebulizer and dilution air. The aerosol mass median particle diameter of 0.46 micrometer and the breadth of the size distribution in terms of geometric standard deviation was 1.5. The size distribution of the polydisperse aerosol at the output is independent of aerosol concentration in the range of interest and is comparable to some fire smokes. Aerosol light obscuration as measured by a standardized photometer was linear with respect to aerosol mass concentration. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N78-25407*# Hughes Aircraft Co., Culver City, Calif.
CLOSED CYCLE ELECTRIC DISCHARGE LASER DESIGN INVESTIGATION Final Report
Philip K. Baily and Richard C. Smith Mar. 1978 95 p refs
(Contract NAS3-20100)
(NASA-CR-135408; P78-128) Avail: NTIS HC A05/MF A01 CSCL 20E

Closed cycle CO2 and CO electric discharge lasers were studied. An analytical investigation assessed scale-up parameters and design features for CO2, closed cycle, continuous wave, unstable resonator, electric discharge lasing systems operating in space and airborne environments. A space based CO system was also examined. The program objectives were the conceptual designs of six CO2 systems and one CO system. Three airborne CO2 designs, with one, five, and ten megawatt outputs, were produced. These designs were based upon five minute run times. Three space based CO2 designs, with the same output levels, were also produced, but based upon one year run times. In addition, a conceptual design for a one megawatt space based CO laser system was also produced. These designs include the flow loop, compressor, and heat exchanger, as well as the laser cavity itself. The designs resulted in a laser loop weight for the space based five megawatt system that is within the space shuttle capacity. For the one megawatt systems, the estimated weight of the entire system including laser loop, solar power generator, and heat radiator is less than the shuttle capacity. Author

N78-25408# National Aerospace Lab., Tokyo (Japan).
A METHOD OF LASER VELOCIMETER DATA PROCESSING
Mitsuo Gomi, Sachiko Kitawara, and Shoichi Fujii Jan. 1978 40 p refs In JAPANESE; ENGLISH summary
(NAL-TR-521) Avail: NTIS HC A03/MF A01

A unique single-particle processor for a frequency-offset laser velocimeter tracker has been devised. Principle and application to turbulent flow measurements are described. Errors inherent in the laser velocimeter are also considered and evaluated. The main features of the single-particle processor are: It picks up only one signal per particle as the particle passes through a measuring volume in the usual optical alignment, and the accuracy of measured data is improved through the use of a processor particularly in highly turbulent flow measurements. Author

N78-25409*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SOFT X-RAY LASER USING CRYSTAL CHANNELS AS DISTRIBUTED FEEDBACK CAVITIES Patent Application
Frank J. Grunthaner, inventor (to NASA) (JPL) Filed 29 Mar. 1978 17 p Sponsored by NASA
(NASA-Case-NPO-13532-2; US-Patent-Appl-SN-891246) Avail: NTIS HC A02/MF A01 CSCL 20E

Liquid neon in a container is forced through channels in a zeolite crystal to a low vacuum chamber. An electron beam is directed into the channels to bombard the flowing neon atoms to produce the characteristic excitation of neon at which X-ray photons are emitted. The channels have periodic changes in their cross sections leading to distributed feedback, so that from the channels in which the neon excitation takes place laser beams are emitted. Using an electron beam with a cross section on the order of 1 micron, the combined laser beams emitted from the various channels form an X-ray beam of a cross section comparable to that of the electron beam. NASA

N78-25410# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
INVESTIGATION OF ABRUPT DECREASES IN ATMOSPHERICALLY BACKSCATTERED LASER ENERGY
Robert Rubio Dec. 1977 26 p refs
(DA Proj. 1L1-61102-B-53A)
(AD-A052231; ECOM-5835) Avail: NTIS HC A03/MF A01 CSCL 20/5

The objective of this study was to determine if two abrupt decreases, as a function of altitude, in atmospherically backscattered laser energy were directly associated with temperature inversion particulate trapping. A ruby lidar system was employed to detect the sharp decreases in laser energy at altitudes of 2.22 km and 2.56 km on the night of 1 November 1974. Aerosols of radius $r<0.1$ micrometer and $1<r<3$ micrometers, collected onboard the da Vinci balloon gondola on the same night provided aerosol density versus altitude profiles. Temperature

and relative humidity altitude profiles, recorded with radiosonde instruments at 2045, 1 November, and 0415, 2 November, revealed the absence of temperature inversions within the laser probed altitude interval. Abrupt changes in relative humidity failed to induce similar changes in the reflected laser energy. The sharp decreases in backscattered laser energy are attributed to a negative density gradient of the 1 micrometer to 3 micrometers radius anhydrous aerosols. This gradient was not located above a temperature inversion and therefore, in this case, the changes in laser signal were found to be unrelated to any temperature inversion trapping mechanism. Author (GRA)

N78-25411# Cornell Univ., Ithaca, N. Y. Lab. of Plasma Studies
STUDIES OF LASER INDUCED PHOTOCHEMICAL KINETICS Final Report, 1 Sep. - 31 Apr. 1977
R. A. McFarlane Dec. 1977 68 p refs
(Grant AF-AFOSR-2781-75; AF Proj. 2303)
(AD-A053077; AFOSR-78-0568TR) Avail: NTIS HC A04/MF A01 CSCL 07/4

Second order quenching rate constants are reported for the quenching of excited iodine atoms (5p(5) (2)p (1/2) by selected molecules. These include I2, O2, H2O, D2O, H2O2, CO2, N2, H2, HD, D2. Temperature dependence studies were made over the range 295 K-600 K. Complex photodecomposition kinetics were observed for I2 and modelled. Author (GRA)

N78-25412# Hughes Aircraft Co., Culver City, Calif.
THE 4.3 MICROMETER LASER DEMONSTRATION EXPERIMENT Final Report, 29 Jun. - 30 Nov. 1977
Jack Finzi and Philip K. Baily Dec. 1977 27 p ref
(Contract N00173-77-C-0174; ARPA Order 2062)
(AD-A052998; HAC-P77-634) Avail: NTIS HC A03/MF A01 CSCL 20/5

The possibility of converting multiline cw DF chemical laser radiation to single line cw 4.3 micrometer radiation by means of an Optical Resonance pumped Transfer Laser (ORTL) is investigated. The ORTL medium consists of a DF and CO2 mixture and a suitable diluent. The optically pumped DF collisionally transfers its vibrational excitation to the CO2. This program is concerned with a demonstration of 4.3 micrometers oscillation between the (00 deg 1) and ground state CO2 levels. A laser demonstration was performed and is described here. ORTL radiation was observed at the wavelength corresponding to the transition of interest. New laser transitions emanating from optically pumped DF molecules were also observed; one of these transitions overlaps the CO2 transition of interest. Factors leading to the conclusion that CO2 ORTL oscillation between the (00 deg 1) level and the ground state were observed and are discussed. Author (GRA)

N78-25413# Chicago Univ., Ill.
LASER SPECTROSCOPIC TECHNIQUE Final Report, 1 Jun. 1975 - 30 Nov. 1977
Lennard Wharton Mar. 1978 6 p refs
(Grant AF-AFOSR-2853-75)
(AD-A052955; AFOSR-78-0677TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

The design, development and exploitation of first and second generation apparatus for studying the spectroscopy of ultra cold molecules by laser induced fluorescence is discussed. This technique was the first joining of supersonic jets and laser optical spectroscopy for the simplification of complex optical spectra, for the observation of new van der Waals molecules, and for the observation of photochemical processes. Author (GRA)

N78-25414# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PHASE-LOCK CONTROL CONSIDERATIONS FOR MULTIPLE, COHERENTLY COMBINED LASERS M.S. Thesis
James Burton Armor, Jr. Dec. 1977 123 p refs
(AD-A052915; AFIT/GEO/EE/77-2) Avail: NTIS HC A06/MF A01 CSCL 20/5

This paper presents design considerations and fundamental performance limitations of phase-lock control loops used to coherently combine an array of lasers. A two-laser control loop designed to lock the differential frequency/phase between two lasers to a specified reference is first investigated. An integro-differential equation, valid for the linearized operating region of the loop, is derived in terms of the specified (desired) phase control, the phase measurement (heterodyne) noise, and the laser phase noise (instabilities). Solution of the equation results in an expression for the lasers: phase error variance in terms of the closed-loop noise equivalent bandwidth, the 100 measurement noise, and the lasers: field linewidths. Loop acquisition time, frequency pull-in range, and steady state phase error are also examined. GRA

N78-25415# Hughes Research Labs., Malibu, Calif.
LASER WINDOW MATERIALS AND OPTICAL COATING SCIENCE Semiannual Technical Report, 19 Mar. - 19 Sep. 1977
M. Braunstein, S. D. Allen, J. A. Harrington, M. E. Pedinoff, and J. E. Rudisill Feb. 1978 124 p refs
(Contract F19628-76-C-0309; ARPA Order 2415)
(AD-A053261; RADC-TR-78-38) Avail: NTIS HC A06/MF A01 CSCL 20/5

The window materials that are under investigation include selected alkali halides and alkaline earth fluorides, in both single and polycrystalline form and of alloyed and unalloyed composition. The enclosed papers discuss the results of work reported at the topical meeting on High Power Laser Optical Components and Component Materials and the Materials for High Power Laser Symposium at the National Bureau of Standards facility in Boulder, Colorado, October 3-6, 1977. The papers are relevant to the major task subdivisions of our program; surface finishing, reactive atmosphere processing, window coatings, optical evaluation and infrared ellipsometry measurements. GRA

N78-25416# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
FIELD PROPERTIES OF MULTIPLE, COHERENTLY COMBINED LASERS M.S. Thesis
Hal E. Hagemeier Dec. 1977 102 p refs
(AD-A053349; AFIT/GEO/EE/77D-3) Avail: NTIS HC A06/MF A01 CSCL 20/5

The coherent combination of several, single mode lasers can produce a field similar to that of a mode-locked laser but with more flexibility. The field for a quasi-monochromatic wave is considered a complex, coherence separable random process. The ensemble mean and covariance are determined for the case of a temporally stabilized amplitude and a temporal phase that with the appropriate assumptions is a stationary, Gaussian random process. Mean fields are used throughout as the 'signals' of interest. The Huygens-Fresnel principle is used to investigate the field properties in the Fraunhofer region for two cases. The first case is for N beams superimposed with optical axes coincident. With appropriate assumptions, the performance of such a system is determined from the ambiguity function. Range measurement precision is found to be proportional to 1./(N cubed x delta f) to the 1/2 power where delta f is the frequency difference between adjacent lasers. Velocity measurement precision is found to be proportional to (N cubed x delta f) to the 1/2 power. The second case is for N beams in a linear array. The far field result is a scanning beam that in certain cases can be steered. Aperiodic arrays are considered in an effort to reduce grating lobes. An array of about 1000 lasers is needed for reasonably low side lobes. Some generalized results are presented for the effects of misalignmentt of the lasers. In addition, the effects of the random phases of the lasers are considered, and the time-space dual nature of the results is discussed. Author (GRA)

N78-25417# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
SPATIAL AND TEMPORAL CODING OF GaAs LASERS FOR A LASER LINE SCAN SENSOR M.S. Thesis
Reese S. Shinkle Dec. 1977 123 p refs
(AD-A053351; AFIT/GEO/EE/77-5) Avail: NTIS HC A06/MF A01 CSCL 20/5

Line of scanning laser sensors which measures range and reflectance are currently being developed to be used as the front end of real-time image processors. This paper establishes the coding combination of intensity modulation and scan pattern for N GaAs laser sources which result in the optimum system performance. A noise model based upon the Poisson point process behavior of a direct (optical intensity) detector is

developed. Estimation theory, based upon the Poisson statistics of the detector, is used to develop the maximum-likelihood (ML) processor for both range and reflectance. The realization of the ML estimator for range is shown to be a correlator or matched filter; a suboptimum realization of the reflectance estimator is shown to be a measurement of the detected signal energy, given the range estimate. Performance expressions are presented to relate the variance of the range and the reflectance to the line scan system parameters and the variance of both is shown to be inversely proportional to the detected signal energy. Various combinations of spatial and temporal coding of the N laser sources to separate the return signal energy from each ground resolution cell while increasing the returned energy per cell, are evaluated. Based upon the variance of the range and reflectance estimates, the optimum spatial-temporal coding combinations are chosen. It is shown that if a large maximum unambiguous range is not required, the best performance possible is achieved with N sources scanned in parallel, each source being sinusoidally modulated. GRA

N78-25418# Naval Research Lab., Washington, D. C.
ATMOSPHERIC EXTINCTION MEASUREMENTS AT Nd-YAG AND DF LASER WAVELENGTHS PERFORMED IN CONJUNCTION WITH THE JAN PROPAGATION TESTS, JUNE - SEPTEMBER 1975 Interim Report
J. A. Dowling, K. M. Haught, R. F. Horton, G. L. Trusty, J. A. Curcio, and W. L. Agambar (Potomac Research, Inc., McClean, Va.) 10 Feb. 1978 86 p refs
(AD-A053271; NRL-8058) Avail: NTIS HC A05/MF A01 CSCL 04/1

The NRL Infrared Mobile Optical Radiation Laboratory (IMORL) consisting of various infrared laser sources, large-aperture collimating optics, and precision calibrated infrared detectors and electronics were operated in conjunction with the JAN Baseline Demonstration Laser propagation tests during June-September 1975. The trailer-housed elements of the IMORL unit were deployed so as to use an atmospheric measurement path about 5 km long between the TRW Capistrano Test Site and Camp Pendleton Marine Base. Extensive measurements of atmospheric transmission at several DF laser wavelengths between 3.6 and 4.1 micrometers were obtained as well as measurements at the Nd-YAG laser wavelength of 1.06 micrometers. The optical measurements were supported by meteorological observations near the IMORL transmitter and receiver sites. Atmospheric aerosol distributions were monitored during the experiments, and Mie scattering calculations were performed using the aerosol data and were compared to aerosol extinction values derived from the optical measurements obtained using the 5-km-long path. The water-vapor dependence of molecular absorption for each of the 22 DF laser lines studied was compared to values obtained during earlier experiments at the Cape Canaveral Air Force Station and to theoretical predictions based on a HITRAN calculation using a line atlas. The experimental apparatus used (IMORL facility) and the measurements procedures followed are briefly described. The measurement results obtained and their comparisons to theoretical predictions for molecular absorption and aerosol scattering at DF laser wavelengths are presented and discussed. Author (GRA)

N78-25419# Sandia Labs., Albuquerque, N. Mex.
CONCEPTS FOR THE CONSTRUCTION OF LARGE REACTOR-EXCITED LASER SYSTEMS
David A. McArthur, T. R. Schmidt, J. S. Philbin, and P. B. Tollefsrud Sep. 1977 92 p refs
(Contract EY-76-C-04-0789)
(SAND-76-0584) Avail: NTIS HC A05/MF A01

Two general concepts for specialized nuclear reactors, designed to excite large volumes of high-pressure laser gas using fission foil arrays, are studied theoretically. Typical characteristics of operating nuclear-pumped lasers are used to define the required neutron flux, excitation geometries and energy output of the fission foils. Neutron transport calculations and neutron kinetics calculations are performed for these geometries, yielding the energy deposition in the laser gas and the reactor temperature rise. Making an optimistic assumption for the ultimately attainable efficiency from nuclear-pumped laser media yields laser powers greater than 1 MW, laser pulse energies approximately greater than 1 MJ and steady-state laser outputs of greater than 100 MJ for moderately-sized, uncooled reactor structures. Areas of further research are suggested to investigate the feasibility of such large lasers. ERA

N78-25420# Addis Translations International, Portola Valley, Calif.
HIGH-SPEED ELECTRON-OPTICAL IMAGE CONVERTERS FOR STUDYING LASER RADIATION WITH PICOSECOND AND FEMTOSECOND TIME RESOLUTION
G. I. Bryukhnevich Aug. 1977 9 p Transl. into ENGLISH from preprint no. 31 (partial transl.), Lebedev Phys. Inst., USSRB Acad. of Sci., Moscow, 1977 Sponsored by DOE Prepared for Calif. Univ., Livermore. Lawrence Livermore Lab.
(UCRL-Trans-11271; Preprint-31) Avail: NTIS HC A02/MF A01

On the basis of experiments and theoretical estimates, ways of modernizing multistage image converters of the PIM-UMI are formulated so as to appreciably increase their time and space resolution in the linear scanning mode. The main models of ultra-high-speed image converters used for studying lasers and laser plasma are described. A method of recording sinusoidally modulated laser radiation for measuring the dynamic characteristics of image converters was developed further. Specific characteristics of the circuits of two-frequency neodymium lasers are discussed. Individual results of measurement of the time MTF of the converters studied are presented. Ways of further improving ultrahigh-speed image converters are outlined. ERA

N78-25421# California Univ., Livermore. Lawrence Livermore Lab.
CRYSTAL SPECTOGRAPH FOR IMAGING HIGH-DENSITY TARGETS
Vincent W. Slivinsky, George R. Leipelt, and J. Del Eckels 21 Oct. 1977 13 p Presented at Ann. Am. Phys. Soc. Meeting, Atlanta, 5-11 Nov. 1977 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-79787; Conf-771136) Avail: NTIS HC A02/MF A01

Laser fusion targets are being designed to achieve 100 times liquid hydrogen density using the LLL Argus laser. One method proposed for diagnosing the high density is to seed the D,T fuel with Ar gas and measure the spatial extent of the region emitting the Ar X-rays. A crystal spectrograph was built to image in 1-D. The spectrograph was calibrated using an 8 microns source of Ag L/sub Beta/X-rays (3.15 keV) from an X-ray machine. ERA

N78-25422# California Univ., Livermore. Lawrence Livermore Lab.
MALAPROP USER'S GUIDE
William E. Warren Aug. 1977 76 p
(Contract W-7405-eng-48)
(UCID-17561) Avail: NTIS HC A04/MF A01

MALAPROP is a CDC 7600 computer program able to simulate laser light propagation through a variety of regions. The primary program task is the integration of a partial differential equation for propagation of a light beam represented by the complex array psi. This equation is computationally integrated for regions with or without gain and for any indices of refraction. In addition, the beam may be spatially filtered or relayed (using FFT methods), expanded or split or passed through an aperture (followed by a no-gain propagation region with a nonlinear index of refraction = 0). Two versions exist allowing for one or two beam dimensions: one space dimension (with saturation) and two space dimensions (without saturation). Optional output includes intensity/phase information (plots and printout), power spectral density information, computed B integral, and saturation information. Initial beam configuration is essentially limited only by array sizes. ERA

N78-25423# California Univ., Livermore. Lawrence Livermore Lab.
FLUORESCENCE-PUMPED PHOTOLYTIC GAS LASER SYSTEM FOR A COMMERCIAL LASER FUSION POWER PLANT
M. J. Monsler 14 Jul. 1977 47 p refs Presented at 20th Ann. AICHE Meeting, N. Y., 13 Nov. 1977
(Contract W-7405-eng-48)
(UCRL-79655; Conf-771102) Avail: NTIS HC A03/MF A01

The conceptual design of a short-wavelength gas laser system suitable for use as a driver (high average power ignition source) for a commercial laser fusion power plant is described. Projected overall system efficiencies of photolytically excited oxygen, sulfur, selenium, and iodine lasers are compared. On the basis of highest projected overall efficiency, a selenium laser was chosen for a conceptual power plant fusion laser system. This laser operates on the 489 nm transauroral transition of selenium, excited by photolytic dissociation of COSe by ultraviolet fluorescence radiation. Power balances and relative costs for optics, electrical power conditioning, and flow conditioning of both the laser and fluorescent gas streams are discussed for a system with the following characteristics: 8 operating modules, 2 standby modules, 125 kJ per module, 1.4 pulses per second, 1.4 MW total average power. The technical issues of scaling visible and near-infrared photolytic gas laser systems to this size are discussed. ERA

N78-25424# California Univ., Livermore. Lawrence Livermore Lab.

LIGHT ABSORPTION AND SCATTERING MECHANISMS IN LASER FUSION PLASMAS

C. Barnes, K. G. Estabrook, W. L. Kruer, A. B. Langdon, B. F. Lasinski, C. E. Max, C. Randall, and J. J. Thomson 4 Oct. 1977 5 p refs Presented at Topical Meeting on Inertial Confinement Fusion, San Diego, Calif., 7 Feb. 1978

(Contract W-7405-eng-48)

(UCRL-80153; Conf-780202-13) Avail: NTIS HC A02/MF A01

Laser light absorption and scattering which are emerging from theory and computer simulation studies of laser-plasma interactions are described. Theoretical and experimental evidence is that resonance absorption in a steepened density profile is a dominant absorption mechanism. Recent work also indicated the presence of critical surface ripples, which were studied by using two and three dimensional computer simulations. Predictions of hot electron spectra due to resonance absorption are described, as are effects of plasma outflow. Brillouin scattering is expected in the underdense target blow-off, for long laser pulses, and is limited by ion heating. Raman scattering in the background gas of a reactor target chamber is predicted to be at most a 10 percent effect for 1 micron lasers. ERA

N78-25425# California Univ., Livermore. Lawrence Livermore Lab.

FAST OPTICAL SHUTTERS FOR NOVA, A HIGH POWER FUSION LASER

L. P. Bradley, W. L. Gagnon, and B. M. Carder 18 Oct. 1977 14 p refs Presented at the 7th Symp. on Fusion Res. Proj., Knoxville, Tenn., 25 Oct. 1977

(Contract W-7405-eng-48)

(UCRL-79699; Conf-771029-116) Avail: NTIS HC A02/MF A01

Preliminary design and performance test results for fast optical shutters intended for use in the Nova high power fusion laser system are briefly described. Both an opening shutter to protect the pellet target from amplified spontaneous emission (ASE), and a closing shutter to protect the laser from light reflected back from the target are discussed. Faraday rotators, synchronized by a 400 Hz oscillator, provide an opening shutter mechanism with an opening time of approximately 10 microseconds. A plasma closing shutter, employing electrical sublimation of a foil, provide a shutter closing time of 70 ns + -20 ns. Energy for foil sublimation is provided by discharge of a 42 J capacitor bank. Implementation of these shutter techniques in the Nova system is anticipated to improve laser output power and efficiency. ERA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N78-25426* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

FLUID VALVE ASSEMBLY Patent

William C. Huber, inventor (to NASA) Issued 11 Apr. 1978 6 p Filed 27 May 1976 Supersedes N76-26511 (14 - 17, p 2197)

(NASA-Case-MSC-12731-1; US-Patent-4,083,380; US-Patent-Appl-SN-690816; US-Patent-Class-137-505.25; US-Patent-Class-137-625.3; US-Patent-Class-137-625.38) Avail: US Patent Office CSCL 13K

A valve assembly is reported for controlling the flow of fluids between the inlet and outlet of a fluid valve. The valve assembly contains a barrier element which is porous for providing fluid communication between the valve inlet and outlet. The valve assembly also includes a sealing element that is movable relative to the barrier element between a first position, in which fluid flow through the porous portion of the barrier element is blocked preventing fluid communication between the valve inlet and outlet, and a second position, in which the porous portion is unblocked, permitting fluid communication between the valve inlet and outlet. Official Gazette of the U.S. Patent Office

N78-25427*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Metals Processes Branch.

WELD PEAKING ON HEAVY ALUMINUM STRUCTURES

E. Bayless, R. Poorman, and J. Sexton Jun. 1978 8 p

(NASA-TM-78176) Avail: NTIS HC A02/MF A01 CSCL 13H

Weld peaking is usually undesirable in any welded structure. In heavy structures, the forces involved in the welding process become very large and difficult to handle. With the shuttle's solid rocket booster, the weld peaking resulted in two major problems: (1) reduced mechanical properties across the weld joint, and (2) fit-up difficulties in subsequent assembly operation. Peaking from the weld shrinkage forces can be fairly well predicted in simple structures; however, in welding complicated assemblies, the amount of peaking is unpredictable because of unknown stresses from machining and forming, stresses induced by the fixturing, and stresses from welds in other parts of the assembly. When excessive peaking is encountered, it can be corrected using the shrinkage forces resulting from the welding process. Application of these forces is discussed in this report. Author

N78-25428*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

TOGGLE MECHANISM FOR PINCHING METAL TUBES Patent Application

Edwin O. Stengard, inventor (to NASA) Filed 19 May 1978 16 p

(NASA-Case-GSC-12274-1; US-Patent-Appl-SN-909100) Avail: NTIS HC A02/MF A01 CSCL 13I

An apparatus is described that uses a toggle mechanism, driven by a stored energy source, for pinching a metal tube and to maintain the tube in a pinched condition without fracturing it. The device is applicable to the multiple gas sampling system for a spectrometer on a Venus probe. NASA

N78-25429*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

COUPLING DEVICE FOR MOVING VEHICLES Patent Application

Arthur A. Rudmann, inventor (to NASA) Filed 19 May 1978 23 p

(NASA-Case-GSC-12322-1; US-Patent-Appl-SN-907436) Avail: NTIS HC A02/MF A01 CSCL 13I

A mechanical system was designed to capture and/or deploy a device or vehicle having relative motion with respect to another vehicle. The mechanism includes an onboard controlled collapsible iris assembly located at the end of a controlled manipulator system carried by one moving vehicle. The iris assembly by means of the manipulator system encircles a probe located on the other moving vehicle whereupon the iris assembly is activated and one or more iris elements close around the probe, thus capturing and axially aligning the other vehicle with the iris assembly. Additionally, a rotator assembly is included for spinning the iris assembly in a manner adapted to engage the probe of a spinning vehicle. NASA

N78-25430*# National Aeronautics and Space Administration. Pasadena Office, Calif.

POWER CONTROL FOR HOT GAS ENGINES Patent Application

William F. MacGlashan, Jr., inventor (to NASA) (JPL) Filed

19 May 1978 25 p
(Contract NAS7-100)
(NASA-Case-NPO-14220-1; US-Patent-Appl-SN-907421) Avail: NTIS HC A02/MF A01 CSCL 10B

A hot gas engine is considered in which the expander piston of the engine is connected to an expander crankshaft, and a displacer piston is connected to a separate displacer crankshaft. Between the two crankshafts is a phase angle control mechanism containing a mating bevel gear that meshes with the first two bevel gears to provide power control. NASA

N78-25431*# National Aeronautics and Space Administration. Pasadena Office, Calif.
HOT GAS ENGINE WITH DUAL CRANKSHAFTS Patent Application
Allan R. McDougal, inventor (to NASA) (JPL) Filed 19 May 1978 29 p
(Contract NAS7-100)
(NASA-Case-NPO-14221-1; US-Patent-Appl-SN-907431) Avail: NTIS HC A03/MF A01 CSCL 10B

A hot gas engine was designed, in which the expander portion is connected to and operates upon an expander crankshaft and the displacer portion is connected to and operable by a separate displacer crankshaft and which crankshafts are synchronized for operation. The engine design inherently produces a compact and rigid hot gas engine construction. Modules of the basic engine component can be assembled in such a way that a very compact highpowered gas engine can be achieved. The engine design also permits the crankcase to adopt more of a cylindrical shape capable of withstanding the high pressures encountered, and thus the entire engine, including the crankcase, can be operated at the same pressure. NASA

N78-25432*# National Aeronautics and Space Administration. Pasadena Office, Calif.
A TOOL FOR USE IN JOINING CONNECTORS TO SHIELDED CABLES Patent Application
Waldo E. Brown, inventor (to NASA) (JPL) Filed 30 May 1978 9 p
(Contract NAS7-100)
(NASA-Case-NPO-14296-1; US-Patent-Appl-SN-910709) Avail: NTIS HC A02/MF A01 CSCL 13I

A tool was designed for use in joining connectors to shielded cables, such as coaxial cables and the like, characterized by a conductor coaxial to a metallic shield. The tool comprises a rigid elongated body configured and dimensioned to be received and held in the palm of a users' hand and includes at one end a truncated flaring cone for flaring the shield and a receiver at the other end for holding the central pin element of the connector prior to the usual crimping operation. The tool is used to exert forces to join and seat the central pin element on the central wire and to engage the insulating material to the full extent of its intended engagement. NASA

N78-25433*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME EFFECTS OF COMPOSITION ON FRICTION AND WEAR OF GRAPHITE-FIBER-REINFORCED POLYIMIDE LINERS IN PLAIN SPHERICAL BEARINGS
Harold E. Sliney and Thomas P. Jacobson May 1978 23 p refs
(NASA-TP-1229; E-9296) Avail: NTIS HC A02/MF A01 CSCL 13I

Oscillating, plain spherical bearings with graphite-fiber-reinforced polyimide (GFRPI) liners were tested for friction and wear from 25 to 315 C. A condensation polymer was compared with an addition polymer, and a high-modulus fiber was compared with a lower cost, low-modulus fiber. All polymer-fiber combinations gave friction coefficients from 0.05 to 0.18 and low wear. Adding CdO and CdI2 reduced the wear of degassed bearings in dry air. These additives were not needed when the bearing liners contained adsorbed moisture. Although, at 25 C, MoS2 reduced the friction and wear of the base composite at unit loads above 70,000,000 N/m squared (10,000 psi), it had no beneficial effect at lighter loads. Author

N78-25434# Transport and Road Research Lab., Crowthorne (England).
ENERGY LOSSES IN HEAVY COMMERCIAL VEHICLES
T. Williams 1977 52 p refs
(PB-277354; TRRL-Suppl-329) Avail: NTIS HC A04/MF A01 CSCL 13F

This report examines the factors affecting the fuel consumption of heavy commercial vehicles. It covers power loss in the engine, tires, vehicle warm-up, and aerodynamic shaping. GRA

N78-25435# Machinability Data Center, Cincinnati, Ohio.
THE MACHINABILITY DATA CENTER Annual Report, 1 Jan. - 31 Dec. 1977
John F. Kahles (Metcut Res. Assoc., Inc.) and John L. Krebs (Metcut Res. Assoc., Inc.) Mar. 1978 52 p refs
(Contract DSA900-77-C-3197)
(AD-A053027; AMMRC-TR-78-13; AR-13) Avail: NTIS HC A04/MF A01 CSCL 05/2

Machinability Data Center (MDC) operations during this reporting period resulted in the successful accomplishment of its contractual goals. Cost recovery income during the period was 72%, measured in actual dollars received for services provided. This center is one of a number of Information Analysis Centers sponsored by the Department of Defense. The specific functions of MDC include the collection, evaluation, storage, and dissemination of information pertaining to machining technology with emphasis on machinability data. The objectives of MDC's efforts are to decrease the cost of machining and to increase the productivity and reliability of machined products in behalf of the Department of Defense and other U.S. Government Agencies and their contractors. Because there is a continuing need for the universal application of evaluated machining data, MDC services are also made available to private industry. GRA

N78-25436# SKF Industries, Inc., King of Prussia, Pa. Research Lab.
DEVELOPMENT OF BASIC PROCESSING TECHNOLOGY FOR BEARING QUALITY SILICON NITRIDE BALLS Final Report
H. M. Dalal, J. W. Rosenlieb, and L. B. Sibley Dec. 1977 65 p refs
(Contract N00019-76-C-0684)
(AD-A053330; SKF-AL77T057) Avail: NTIS HC A04/MF A01 CSCL 13/9

This is the Final Report on the Development of Basic Processing Technology for Bearing Quality Silicon Nitride Balls. Substantial rolling contact fatigue life data generated on balls have demonstrated the potential of this material for reliable long life. To provide a cost-effective manufacturing technology, fabrication of rough spheres directly from silicon nitride powder was undertaken. These were finished into 17.5mm size balls to generate rolling contact fatigue life data comparable to that available in the literature. GRA

N78-25437# Metcut Research Associates, Inc., Cincinnati, Ohio.
MATHEMATICAL MODELING OF MATERIAL REMOVAL PROCESSES FOR IMPROVED PROCESS DESIGN, PLANNING, OPTIMIZATION, AND CONTROL Final Report, Apr. 1976 - Jul. 1977
V. A. Tipnis, S. A. Vogel, S. C. Buescher, R. C. Garrison, and R. E. DeVor Wright-Patterson AFB, Ohio AFML Sep. 1977 340 p refs Prepared in cooperation with Illinois Univ., Urbana
(Contract F33615-76-C-5254)
(AD-A053339; AFML-TR-77-154; Rept-1566-23599) Avail: NTIS HC A15/MF A01 CSCL 13/8

Results of work for the development of methodologies for mathematical modeling and economic analysis of material removal processes were presented. Initially, an extensive literature review was conducted to identify the major unsolved problem areas and to examine the necessary techniques for their solution. The major problems identified were: (1) the selection of levels and positions of independent variables during the planning of experiments; (2) definition of the working region within which the model is valid, and (3) incorporation of variable radial depth and/or feed during a given cut. A methodology for solving problems (1) and (2) was developed and verified through analysis of available machining data from end milling tests (Contract No. F33615-74-C-5025) and from turning (Contract No. F33615-73-C-5180). A series of end milling tests with variable radial depth and/or feed were conducted to determine

the effect of in-process changes in machining variables on tool wear and tool life. Shop floor validation of the laboratory data was carried out. Economic analysis for process design, planning and optimization was conducted through the development of macro-economic and microeconomic models. GRA

N78-25438# Brookhaven National Lab., Upton, N. Y.
SINGLE CYLINDER SPARK IGNITION ENGINE STUDY OF NO AND NO2 EMISSIONS FOR METHANOL, ISO-OCTANE AND NITROGEN DOPED METHANOL WITH EMPHASIS ON MEASUREMENT TECHNIQUE
J. H. Brateman and R. B. Klemm 1977 26 p refs Presented at the Fall 1977 Meeting, Eastern States Sect., the Combust. Inst., Hartford, Conn., 10-11 Nov. 1977
(Contract EY-76-C-02-0016)
(BNL-23549; Conf-771149-3) Avail: NTIS HC A03/MF A01

NO and NO2 emissions from a single cylinder CFR engine were measured as a function of fuel air equivalence ratio for the spark ignited combustion of methanol, iso-octane and nitrogen doped methanol. In all cases, no NO2 was detected for fuel-rich or stoichiometric combustion, while significant amounts of NO2 were found for fuel-lean combustion. The exhaust system and exhaust sampling system were thoroughly tested for NO and NO2 conversions, NO2 to NO conversions and NO/sub x/loses. Several devices for desicating the exhaust sample were tested to determine their effects on the NO/sub x/ concentration of the sample. For the fuel-nitrogen case, significant increases in the NO/ sub x/ emissions were measured at fuel-lean equivalence ratios. NO increase in the NO/sub x/ emissions were detected at rich conditions. ERA

N78-25439# Mechanical Technology, Inc., Latham, N. Y.
DESIGN STUDY FOR HIGH-PRESSURE HIGH-FLOW OXYGEN CENTRIFUGAL COMPRESSOR, PHASE 1 Final Report
D. G. Dominy Dec. 1976 258 p refs
(Contract EX-76-C-01-2366)
(MTI-77TR17) Avail: NTIS HC A12/MF A01

Activities are reported in a program to produce a conceptual design for an oxygen centrifugal compressor which will satisfy the flow rate and pressure requirements for commercial size coal gasification plants. Program results show that the basic engineering technologies for aerothermodynamic and mechanical design together with stress analysis, bearing technology, etc., exist now and has existed for many years for the construction of large flow, high-pressure centrifugal compressors. A fundamental requirement for any compressor flowing hazardous or non-hazardous gas is a good sound mechanical design reflecting the best facets of the mechanical designs' art unhindered by cost restrictions. The mechanical design and control system must protect the compressor as much as possible against human error in any form. ERA

N78-25440# California Univ., Livermore. Lawrence Livermore Lab.
DETERMINATION OF THE EFFECTIVENESS AND FEASIBILITY OF REGENERATIVE BRAKING SYSTEMS ON ELECTRIC AND OTHER AUTOMOBILES. VOLUME 1: SUMMARY Final Report
D. D. Davis, R. A. Renner, F. C. Younger, R. C. Epps, and S. S. Lerner 9 Sep. 1977 77 p refs 2 Vol.
(Contract W-7405-eng-48)
(UCRL-52306/1) Avail: NTIS HC A05/MF A01

A determination of the effectiveness and feasibility of regenerative braking systems on electric and other automobiles was made. Regenerative braking concepts applicable to autos utilizing electric, hybrid, or heat engine power systems were evaluated to determine performance improvement, energy savings, and cost effectiveness. Two major conclusions were reached pertaining to privately owned autos driven 16,100 km/yr in an urban environment: (1) regenerative braking is cost effective and is recommended for use on electric and hybrid-powered automobiles, and (2) the addition of a regenerative braking system to the standard heat-engine-powered auto was not found to be cost effective. However, the regenerative system can be cost effective for heat engine powered commercial vehicles such as taxis, city buses, or delivery vans that see high annual usage under stop-and-go conditions. Author (ERA)

N78-25441# California Univ., Livermore. Lawrence Livermore Lab.
DETERMINATION OF THE EFFECTIVENESS AND FEASIBILITY OF REGENERATIVE BRAKING SYSTEMS ON ELECTRIC AND OTHER AUTOMOBILES. VOLUME 2: DESIGN STUDY AND ANALYSIS Final Report
D. D. Davis, R. A. Renner, F. C. Younger, R. C. Epps, and S. S. Lerner 9 Sep. 1977 288 p refs 2 Vol.
(Contract W-7405-eng-48)
(UCRL-52306/2) Avail: NTIS HC A13/MF A01

The details of the analysis performed are given plus appendices in which study team members and organizations contacted are listed and supporting data are compiled. ERA

N78-25442# Curtiss-Wright Corp., Wood-Ridge, N.J.
HIGH TEMPERATURE TURBINE TECHNOLOGY PROGRAM. PHASE 1: COMBINED CYCLE ELECTRIC POWER PLANT WITH COAL DERIVED LOW Btu GAS OR COAL-LIQUID FUEL, BOOK 2 Final Report
May 1977 155 p refs
(Contract EY-76-C-01-2291)
(FE-2291-18-Bk-2) Avail: NTIS HC A08/MF A01

The overall objective of the ERDA High Temperature Turbine Technology program is to develop a high temperature turbine subsystem capable of operating in an environmentally acceptable manner on a coal-derived low BTU gas or on a coal-derived liquid fuel at inlet temperatures of from 2600 to 3000 F. The Phase 1 objective was to define the systems and the development efforts required during Phase 2 (Technology Testing and Support Studies) and the Phase 3 (Verification Test Program) to bring these systems to technology readiness. Conceptual designs of commercial combined/cycle plants utilizing the coal-fueled high temperature turbine system were part of the Phase 1 effort. Selection of the turbine cooling concept and design definition of the high temperature turbine subsystem were also established. This volume contains information on the preliminary design of the three low-BTU gas combustors; low BTU combustor technology development plan; program plans for Phase 2 and Phase 3; research and technology requirements; and reliability including failure mode analysis. ERA

N78-25443# Department of Energy, Morgantown, W. Va. Energy Research Center.
HIGH PRESSURE ROTARY PISTON COAL FEEDER
John F. Gardner, H. T. Gencsoy (West Va. Univ., Morgantown), and Donald C. Strimbeck Dec. 1977 12 p
(MERC/SP-77/6) Avail: NTIS HC A02/MF A01

A coal feeder with discharge capabilities of 1500 psig and 350 F was designed and described. The feeder consists of a rotating disk in a cyclindrical feed chamber containing a reciprocating piston. The piston seals the feed chamber after the coal is dumped into a reactor vessel so that there is no loss of gas from the reactor. These are the only moving parts in the feeder, and their rugged construction should present minimum wear problems. The feeder is designed for 1200 pounds per hour, operating at 30 rpm. The compact design makes it possible to use more than one feeder in parallel to get higher coal feed rates. Higher values of rotational speed could also increase the feed capacity. The drive requirement of a single unit at 30 rpm is 5.3 horsepower. ERA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N78-25444# State Univ. of New York, Stony Brook. Dept. of Materials Sciences.
NON-DESTRUCTIVE EVALUATION OF MATERIALS WITH COLD NEUTRON BEAMS
Herbert Herman Dec. 1977 164 p
(Contract N00019-77-M-0418)
(AD-A053073) Avail: NTIS HC A08/MF A01 CSCL 14/4

A study is presented on the possibilities of using cold neutrons

for non-destructive evaluation (NDE). There are shown to be two sectors where cold neutrons can be effectively employed: (1) cold neutron radiography (CNR); and (2) small-angle neutron scattering (SANS). CNR is an established method of radiography with low energy, long wavelength neutrons, enabling greatly improved contrast and resolution over normal radiographic methods. This improvement will be especially important for hydrogenous materials, for example, contained within thick steel sections (e.g., one mm of plexiglas imbedded between two 7 cm section of steel plates). The main limitations to the use of CNR are portability and expense of the cold neutron source. SANS is actually a scattering method for detecting heterogeneities (10-10,000 A) imbedded within a matrix of different neutron scattering power. SANS has been employed by workers in Italy over a remarkable range of applicability, from predicting failure in nickel-base superalloy turbine blades to a study of debonding of fibers in carbon-carbon fiber composites. Again, as with CNR, applied SANS suffers from the need of a high flux of cold neutrons. The possibilities and limitations of SANS for NDE, with special reference to Naval needs, are examined. GRA

N78-25445# Forest Products Lab., Madison, Wis.
DIFFERENTIAL RELIABILITY: PROBABILISTIC ENGINEERING APPLIED TO WOOD MEMBERS IN BENDING/TENSION
Stanley K. Suddarth, Frank E. Woeste, and William L. Galligan 1978 19 p refs
(AD-A053100; FSRP-FPL-302) Avail: NTIS HC A02/MF A01 CSCL 13/13

Reliability analysis is a mathematical technique for appraising the design and materials of engineered structures to provide a quantitative estimate of probability of failure. Two or more cases which are similar in all respects but one may be analyzed by this method; the contrast between the probabilities of failure for these cases allows strong analytical focus on the case differences. This comparative procedure is known as differential reliability analysis. The technique is demonstrated by means of an example involving a simple truss member. Applications of reliability analysis important to truss design are discussed. Differential reliability analysis is shown to be of value for code calibration purposes--that is, for evaluating new products or structural systems in terms of the prevailing practice. Reliability analysis can also be valuable for predicting future design-and-use payoff for investments in material properties research.
Author (GRA)

N78-25446# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
NONDESTRUCTIVE TESTING DEVELOPMENT PROGRAM Quarterly Progress Report, period ending 30 Sep. 1977
M. R. Hill, comp. Nov. 1977 53 p refs Prepared in cooperation with ANL, Ill., G. E. Co., Fairfield, Conn., and Hanford Engineering Development Lab., Richland, Wash.
(Contract W-7405-eng-26)
(ORNL-5350) Avail: NTIS HC A04/MF A01

Nondestructive testing (NDT) research for LMFBR components is summarized. Included are NDT techniques and equipment for inspection and monitoring of welded joints and steam generators. NDT methods discussed employ ultrasonics, radiography, and eddy currents. ERA

N78-25447# Bendix Corp., Kansas City, Mo.
FACTORS AFFECTING VISUAL INSPECTION OF THIN FILM NETWORK
R. E. Hines Jan. 1978 15 p refs
(Contract EY-76-C-04-0613)
(BDX-613-1673) Avail: NTIS HC A02/MF A01

The effect of various types of reflected illumination, the effect of defect size or shape, the time required for inspection, and the inspection uniformity were evaluated. The use of polarized light is recommended for the visual inspection of thin film networks. ERA

N78-25448# Argonne National Lab., Ill.
EVALUATION OF A PULSED EDDY-CURRENT SYSTEM FOR SUBSURFACE FLAW DETECTION
K. J. Reimann and A. Sather Dec. 1977 14 p refs
(Contract W-31-109-eng-38)
(ANL/MSD-78-1) Avail: NTIS HC A02/MF A01

A pulsed eddy current system was evaluated for subsurface flaw detection capabilities in stainless steel. The standard probes, designed for flaw detection in thin specimens, were able to indicate the presence of 3 mm holes 3 mm below the surface of a stainless steel test block. A special probe was constructed in order to obtain a deeper penetration into the material. With the probe, 3 mm subsurface holes to a depth of 9 mm could be detected. No optimization of probe design parameters was attempted. ERA

N78-25449# Environmental Monitoring and Support Lab., Las Vegas, Nev.
QUALITY CONTROL FOR ENVIRONMENTAL MEASUREMENTS USING GAMMA-RAY SPECTROMETRY Final Report, FY 1977
Lee H. Ziegler and Hiram M. Hunt Dec. 1977 159 p refs
(PB-277377; EPA-600/7-77-144) Avail: NTIS HC A08/MF A01 CSCL 14D

The quality control procedures, calibration, collection, analysis, and interpretation of data in measuring the activity of gamma ray-emitting radionuclides in environmental samples are described. Basic data for selected gamma ray emitting radionuclides, the uranium 235 series, the uranium 238 series, and the thorium 232 series are presented. Typical pulse height spectra of selected gamma ray-emitting radionuclides measured with a NaI(T1) detector are included. Author

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N78-25450+ Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Dept.
NATURAL FREQUENCIES OF A FOUR POINT-SUPPORTED RECTANGULAR PLATE USING THE RAYLEIGH-RITZ METHOD
J. Kerstens Mar. 1977 38 p refs
(FOK-RV-77-38) Avail: NTIS HC A03

In the design of solar panels the first natural frequency must be as high as possible for a plate supported by four hold-down points. The energy method is used to obtain the fundamental frequency of this plate. This fundamental frequency is computed using the Rayleigh-Ritz method. Author (ESA)

N78-25451# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
FATIGUE STRENGTH CALCULATION METHODS
Alfred Buch Sep. 1977 132 p refs
(TAE-314) Avail: NTIS HC A07/MF A01

The modifying factors, which take into account the influence on fatigue limit of stress concentration, loading type, specimen size, cross-section shape, mechanical surface treatment etc., are given. A two parameter formula of the notch factor was derived for calculation of the fatigue strength of Al-alloy components. The two parameter formula takes into account the effect of cyclic strain hardening. A conservative approximation of S-N lines notched specimens (in the complete reversed loading case, sigma sub m = 0) is described. Some fatigue strength calculation methods in the case of combined static and alternating loading (sigma sub m not equal to 0) are considered. Some basic fatigue data sheets are presented for use in the calculation examples. The effect of special treatments on the fatigue limit was qualitatively evaluated. Practical examples for use of the damage cumulation rule are presented. All considered methods for evaluation of fatigue life (N) or strength (sigma) try to take into account the need to receive, as a rule, estimates on the safe side. Author

N78-25452# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
EFFECT OF LOADING-PROGRAM MODIFICATIONS IN

ROTATING-BENDING TESTS ON FATIGUE DAMAGE CUMULATION IN AIRCRAFT MATERIAL SPECIMENS
Alfred Buch Nov. 1977 42 p refs
(TAE-325) Avail: NTIS HC A03/MF A01

Multilevel rotating bending block tests were performed and the effect of stress peaks on the damage sum of notched aircraft material specimens was investigated. Test results were compared from the view points of the residual stress concept and of the nonlinear, stress dependent damage cumulation approach. The residual stress concept seems to be valid not only for nonsymmetrical axial loading but also for some rotating binding loading sequences, when stress peaks are acting. The nonlinear stress dependent damage cumulation approach is in good qualitative agreement with rotating bending test results, in the case where the role of residual stresses is negligible. Author

N78-25453# National Aerospace Lab., Tokyo (Japan). Second Airframe Div.
RELATIONSHIP BETWEEN SCATTER OF FATIGUE LIFE AND S-N CURVE OF 2024-T4 AIRCRAFT STRUCTURAL ALUMINUM ALLOY SPECIMENS WITH A SHARP NOTCH (Kt EQUALS 8.25) UNDER A CONSTANT TEMPERATURE AND HUMIDITY CONDITION
Toshiyuki Shimokawa and Yasumasa Hamaguchi Oct. 1977 14 p refs Repr. from J. of the Japanese Soc. for Strength and Fracture of Mater. (Japan), v. 10, no. 2, 1975
(NAL-TR-412T) Avail: NTIS HC A02/MF A01

The accumulated effect of all factors producing fatigue life scatter, which is found in a fatigue test by nominally identical specimens subjected to nominally identical repeated stresses, is regarded as an error in applied stress. Equivalent stress is defined as the sum of applied stress and the error in applied stress. This concept is used for analyzing the results of a series of fatigue tests on aircraft structural aluminum alloy specimens with a sharp notch under a constant temperature and humidity condition. The interrelationship between scatter of equivalent stress, and fatigue life scatter is discussed. It is shown that equivalent stresses are distributed in almost normal distribution and their standard deviation is nearly constant regardless of stress level, and that fatigue life distribution has a strong correlation to the slope and shape of S-N curve. Author

N78-25454# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
THE DAMAGE SUM IN FATIGUE OF STRUCTURE COMPONENTS
Alfred Buch 1978 15 p refs Repr. from Eng. Fracture Mech. (England), v. 10, 1978 p 233-247
(ICAF-1032) Avail: NTIS HC A02/MF A01

The effect of loading spectrum parameters and type of tested specimen was studied from the viewpoints of deviations from Miner's rule and of the value of the minimum cycle ratio sum at failure. A minimum cycle sum may be chosen for sufficiently high values of spectrum parameters sigma max and sigma min. The increase of the cycle ratio sum with the parameters of the spectrum is connected with the effect of increased strain hardening and residual compressive stresses. Some complex effects of sigma max and of the failure stress level on the damage sum were observed, which cannot be explained by the residual stress concept. A normal and a reversed loading sequence effect was established in two-stress level tests. Author

N78-25455# Israel Aircraft Industries Ltd., Lod.
ANALYTICAL AND EXPERIMENTAL FATIGUE PROGRAM FOR THE KFIR MAIN AND NOSE LANDING GEARS
B. Abraham 1977 7 p refs Repr. from Israel J. of Tech. (Israel), v. 15, 1977 p 70-78 Presented at the 19 ISR Ann. Conf. on Aviation and Astronautics, Israel, 1977
Avail: NTIS HC A02/MF A01

The fatigue program began in the detail phase; next came the development of loading spectra used for analysis and test. A fatigue analysis was then performed for several suspected critical locations on both gears. A flight-by-flight test was performed on both landing gears with the aim of demonstrating four service lifetimes of operation. Design modifications were introduced, based on the results of these tests. Rational inspection and replacement intervals were established for the main and nose gear, some of which require monitoring of aircraft. Author

N78-25456# Technische Universitaet, Munich (West Germany). Lehrstuhl B fuer Mechanik.
DYNAMICS AND CONTROL OF FLEXIBLE HYBRID STRUCTURES
Hartmut Bremer 17 Feb. 1978 31 p refs Backup document for AIAA Synoptic, "Dynamics of Flexible Hybrid Structures", scheduled for publication in Journal of Guidance and Control in Jan.-Feb. 1979
Avail: NTIS HC A03/MF A01

Because flexible hybrid structures are interconnected rigid and elastic bodies, the results of elastodynamics cannot directly be applied to such systems and conditions of self-adjointness and orthogonality must be generalized. To this end, an extended Hamilton principle is considered. Its modified use leads directly to the mentioned conditions and a formal method is obtained to derive the equations of motion, yielding ordinary differential equations which can be treated by known procedures. In order to derive an optimal control law, however, controllability conditions must be recalculated for hybrid systems, because the location of torquers will be of some importance, and unstable motions which can arise from the elastic oscillation must be taken into account. The developed procedure is applied to the Large Space Telescope as a nonrotating flexible structure. Author

N78-25457*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
EFFICIENCY OF UNCONSTRAINED MINIMIZATION TECHNIQUES IN NONLINEAR ANALYSIS
Manohar P. Kamat and Norman F. Knight, Jr. May 1978 50 p refs
(Grant NGR-47-004-114)
(NASA-CR-2991) Avail: NTIS HC A03/MF A01 CSCL 20K

Unconstrained minimization algorithms have been critically evaluated for their effectiveness in solving structural problems involving geometric and material nonlinearities. The algorithms have been categorized as being zeroth, first, or second order depending upon the highest derivative of the function required by the algorithm. The sensitivity of these algorithms to the accuracy of derivatives clearly suggests using analytically derived gradients instead of finite difference approximations. The use of analytic gradients results in better control of the number of minimizations required for convergence to the exact solution. Author

N78-25458*# Old Dominion Univ. Research Foundation, Norfolk, Va.
ANALYTICAL AND NUMERICAL INVESTIGATION OF STRUCTURAL RESPONSE OF COMPLIANT WALL MATERIALS, PART 1 Progress Report
R. Balasubramanian May 1978 98 p refs
(Grant NsG-1236)
(NASA-CR-2999) Avail: NTIS HC A05/MF A01 CSCL 20K

Surface motion of compliant walls in drag reduction experiments was analyzed. Critical comparison was made between the dynamic motion of the structure and the postulated mechanism of drag reduction. The spectrum of surface motion indicated that membranes over deep cavities respond at low frequencies and large wavelengths. The membrane over a deep cavity is therefore found not to yield the desired response predicted by the postulated mechanism. The membrane over a thin air gap is found to act as a wavelength chopper, and analysis of the nonlinear response of that compliant surface indicated its possible suitability for compliant wall experiments. Periodic structures are found to lock in the desired wavelengths of motion, and it was shown that at least in Kramer's initial experiments they produced high frequency surface motions. Laminated structures are found to be very ineffective as compliant models, except when there is no bonding between the membrane and the backing. Computer programs developed for these analyses are documented. Author

N78-25459*# Clemson Univ., S.C.
PRELIMINARY INVESTIGATION OF CRACK ARREST IN COMPOSITE LAMINATES CONTAINING BUFFER STRIPS
James G. Goree 1978 61 p refs
(Grant NsG-1297)
(NASA-CR-3000) Avail: NTIS HC A04/MF A01 CSCL 20K

The mechanical properties of some hybrid buffer strip

laminates and the crack arrest potential of laminates containing buffer strips were determined. The hybrid laminates consisted of graphite with either S-glass, E-glass, or Kevlar. Unnotched tensile coupons and center-cracked fracture coupons were tested. Elastic properties, complete stress/strain curves, and critical stress intensity values are given. The measured elastic properties compare well with those calculated by classical lamination theory for laminates with linear stress/strain behavior. The glass hybrids had more delamination and higher fracture toughness than the all-graphite or the Kevlar hybrid. Author

N78-25460# Technische Univ., Berlin (West Germany).
VIBRATION OF STRUCTURAL MEMBERS CAUSED BY NONSTATIONARY EXCITATION [BAUWERKS-SCHWINGUNG INFOLGE NICHTSTATIONAERER ER-REGUNG]
Paul Klippel 1977 102 p refs In GERMAN
(ILR-Ber-24) Avail: NTIS HC A06/MF A01

Numerical parameterization methods are developed for predicting responses of structures and structural members to dynamic loads. Application of oscillatory velocities for estimating dynamic loads acting on vibrating structures establishes a correlation between extreme bending stress and extreme oscillation velocity, regardless whether stationary/periodic- or transient- excitations are applied. Transl. by G.G.

N78-25461# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
FOUR LECTURES ON FATIGUE CRACK GROWTH
J. Schijve Oct. 1977 88 p refs
(VTH-LR-254) Avail: NTIS HC A05/MF A01

Topics include fracture crack growth and fracture mechanics, fatigue cracks, plasticity effects, and crack closure, fatigue crack propagation, prediction, and correlation, and fatigue crack growth under variable amplitude loading. For individual titles, see N78-25462 through N78-25465.

N78-25462 Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
FATIGUE CRACK GROWTH AND FRACTURE MECHANICS
In its Four Lectures on Fatigue Crack Growth Oct. 1977 p 1-19 refs (For availability see N78-25461 16-39)
HC A05/MF A01

Aspects of the technical meaning of fatigue considerations in practices are indicated. Fatigue life is subdivided into a crack nucleation period and a crack propagation period. The significance of recognizing these periods for practical problems is illustrated by several examples. The similarity approach for correlating fatigue data is introduced. The meaning of the stress intensity factor for fatigue crack growth is discussed.
Author (ESA)

N78-25463 Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
FATIGUE CRACKS, PLASTICITY EFFECTS AND CRACK CLOSURE
In its Four Lectures on Fatigue Crack Growth Oct. 1977 p 20-41 refs (For availability see N78-25461 16-39)
HC A05/MF A01

Concepts introduced are residual plastic deformation, residual stress, reversed plastic deformation, plastic deformation in the wake of the crack, and crack closure under tensile load. As a method of determining the crack closure level, COD measurements are discussed. The significance of crack closure for fatigue crack growth is analyzed and illustrated by several examples, including effects of yield stress, stress ratio, and delayed crack growth after a peak load. Three-dimensional aspects following from thickness effects, shear lips, and curved crack fronts are examined. Author (ESA)

N78-25464 Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
FATIGUE CRACK PROPAGATION, PREDICTION AND CORRELATION
In its Four Lectures on Fatigue Crack Growth Oct. 1977 p 42-59 refs (For availability see N78-25461 16-39)
HC A05/MF A01

Two prediction techniques are introduced: cycle-by-cycle prediction and prediction by correlation. The problem of describing variable-amplitude loading in terms of load cycles is considered. Aspects of fatigue damage are reviewed with reference to interaction effects and weaknesses in cycle-by-cycle prediction methods. The discussion on prediction by correlation is restricted to constant-amplitude loading. The validity of the similarity concept based on K-factors is reconsidered. Application of simple specimen data to complex structures is shown. Finally, a variety of crack growth equations is reviewed, including aspects of curve fitting, a comparison between formulas of Walker and Elber, and asymptotic values in the da/dn delta K relation. Author (ESA)

N78-25465 Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
FATIGUE CRACK GROWTH UNDER VARIABLE-AMPLITUDE LOADING
In its Four Lectures on Fatigue Crack Growth Oct. 1977 p 60-83 refs (For availability see N78-25461 16-39)
HC A05/MF A01

Stationary and nonstationary types of variable-amplitude loading are specified. The description of stationary random load was examined and the stress intensity factor applied to crack growth under stationary variable-amplitude loading by defining first characteristic stresses and characteristic stress intensity factors. This was done for random loading, nonrandom loading and flight-simulation loading. How and why this concept may break down if the stationarity is lost is discussed. Attention is paid to truncation of high loads in a flight-simulation test and the analogous problem of the crest factor under random loading. The significance of crack closure for understanding crack growth under variable-amplitude loading is emphasized. Author (ESA)

N78-25466# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENTAL STUDY TO DETERMINE THE REDUCTION IN ULTIMATE BENDING MOMENT OF A COMPOSITE PLATE DUE TO AN INTERNAL DELAMINATION M.S. Thesis
Robert Gary Sprigg Dec. 1977 38 p refs
(AD-A052662) Avail: NTIS HC A03/MF A01 CSCL 20/11

The purpose of this study was to determine experimentally the effects of internal delaminations in a graphite-epoxy composite plate on the plate's ultimate bending moment. The experiments were conducted using 4 inch by 7 inch specimens with a balanced 0, or - 45, 90, 8 ply layup. The delaminations were created by inserting a thin teflon disc between two lamina during layup preparation. The location of the disc, i.e. delamination, was varied in each test, and two disc sizes were considered. The test results revealed that delaminations located near an outer surface resulted in a greater reduction in the ultimate moment than those located near the center of the layup. Furthermore, the reduction in ultimate bending moment was found to be independent of the disc size. The tendency for the internal delaminations to propagate at relatively low load levels was observed and recorded. Author (GRA)

N78-25467# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.
STUDY OF GRAIN BOUNDARY SEGREGATION USING THE AUGER ELECTRON EMISSION TECHNIQUE Annual Technical Progress Report, 1 Jan. - 31 Dec. 1977
D. F. Stein, L. A. Heldt, S. P. Clough, J. A. Hack, T. R. Pinchback, and S. J. Vonk 1977 42 p refs
(COO-2166-24; ATPR-7) Avail: NTIS HC A03/MF A01

An analysis of plastic flow at the tip of a propagating crack during brittle fracture is developed. The plastic flow analysis takes into account the anisotropy of slip by a mixed mode opening scheme. Values of the true fracture energy for different crack systems are obtained; the effects of an embrittling agent can be taken into account. The fracture stress of Cu--Bi alloys having varied grain sizes and Bi concentrations were measured. Auger analysis indicated a large variation of Bi segregated to boundaries in coarse grained materials with smaller variations in fine grained materials. The grain boundary diffusion of nickel was studied in the Cu--Bi alloy system. Possible effects of solute segregation in determining SSC susceptibility of copper alloys in acid sulfate solutions were examined with high purity binary alloys. Electro-

chemical measurements revealed an active path for SCC in segregated Cu--Sb and Cu--Bi alloys. ERA

N78-25468# Oak Ridge National Lab., Tenn.
MECHANICAL PROPERTIES TEST DATA FOR STRUCTURAL MATERIALS Quarterly Progress Report, 31 Jul. 1977
M. R. Hill, comp. Sep. 1977 409 p refs
(Contract W-7405-eng-26)
(ORNL-5326) Avail: NTIS HC A18/MF A01

Progress in structural materials mechanical properties test programs is reported. ERA

N78-25469# Addis Translations International, Portola Valley, Calif.
LOCAL BEHAVIOR OF REINFORCED CONCRETE WALLS UNDER MISSILE IMPACT
C. Berriaud, A. Sokolovsky, R. Gueraud, and R. Labrot Nov. 1977 28 p Transl. into ENGLISH from FRENCH Paper no. J7/9
(SAND-77-6021; Conf-770807-56) Avail: NTIS HC A03/MF A01

The local effect of the crash of a rigid projectile such as an aircraft engine on the reinforced concrete walls used for reactor containment in nuclear power plants was investigated. A method for computing the behavior of reinforced concrete walls under missile impacts is described. The shots were performed on reinforced concrete slabs, the thicknesses of which were chosen to represent in a realistic way the thickness of the wall of a reactor containment. The scales used in this modeling were mainly one half and one third. The similarity law used is, in this case, to keep the value of velocity unchanged. The results to date are described. ERA

N78-25470# Sandia Labs., Albuquerque, N. Mex.
EFFICIENT NUMERICAL METHOD FOR TIME INDEPENDENT PLASTICITY
Raymond D. Krieg Nov. 1977 20 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0943) Avail: NTIS HC A02/MF A01

A numerical method for the solution of plasticity equations is presented. The plasticity model is a commonly used elastic-plastic strain hardening model for combined isotropic kinematic hardening with Ziegler's modification. Thermal strains and temperature variable properties are included. The method was also specialized to the nonthermal linear strain hardening case where only two additional vector and two scalar algebraic equations, including one square root, are needed over that needed for the elastic case. The method has roughly the same accuracy as conventional numerical treatments of the plasticity equations but requires roughly one-third as much computational time. ERA

N78-25471# California Univ., Livermore. Lawrence Livermore Lab.
STIFFNESS AND FLEXIBILITY ELEMENT FOR SAP4
D. W. Coats 27 Oct. 1977 7 p
(Contract W-7405-eng-48)
(UCID-17654) Avail: NTIS HC A02/MF A01

A stiffness and flexibility element was added to the SAP4 program. Direct input of a member stiffness or member flexibility matrix is now possible. This element is used to reduce significantly the number of degress of freedom in a large mathematical model by presenting a portion or portions of the structure with one or more of these elements. ERA

N78-25472# Sandia Labs., Albuquerque, N. Mex. Computational Physics and Mechanics Div.
VON NEUMANN STABILITY OF THE WONDY WAVECODE FOR THERMODYNAMIC EQUATIONS OF STATE
D. L. Hicks Nov. 1977 31 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0934) Avail: NTIS HC A03/MF A01

In a thermodynamic equation of state p is allowed to depend also on the specific entropy, S (or on the specific internal energy, epsilon). If p does not depend on epsilon (or S), then the Grueneisen parameter, GAMMA, is zero. A von Neumann stability analysis of WONDY is done for the more general case when GAMMA is not equal to 0. The result of this analysis is the requirement that the timestep be less than the product of the material increment and a certain function f of the acoustic impedance (a); artificial viscosity coefficient, lambda; and GAMMA. In a region of compression, if lambda GAMMA is greater than 0, then f(a, lambda, GAMMA) is smaller than f(a, lambda, 0). Therefore, the more general stability analysis yields the result that the timestep restriction now in Wondy may be insufficient for stability in certain regions of certain calculations. ERA

42 GEOSCIENCES (GENERAL)

N78-25473# World Meteorological Organization, Geneva (Switzerland).
EDUCATION AND TRAINING IN METEOROLOGICAL ASPECTS OF ATMOSPHERIC POLLUTION AND RELATED ENVIRONMENTAL PROBLEMS
1977 384 p refs Proc. of WMO/UN Environment Programme Meeting, Res. Triangle Park, N.C., 31 Jan.-4 Feb. 1977
(WMO-493; ISBN-92-63-10493-X) Avail: NTIS HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

Twenty-two papers on various aspects of air pollution effects, forecasting, and monitoring and related environmental fields are presented together with outlines of syllabi for the education and training of meteorologists in these aspects. For individual titles, see N78-25474 through N78-25495.

N78-25474 World Meteorological Organization, Geneva (Switzerland).
RECENT CLIMATIC TRENDS **c47**
James K. Angell *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 3-20 refs (For availability see N78-25473 16-42)
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Recent trends in global temperature and ozone are discussed and illustrated with graphs. Trends for stratospheric water vapor amount and carbon dioxide are also briefly considered. ESA

N78-25475 World Meteorological Organization, Geneva (Switzerland).
RESEARCH TRENDS IN ATMOSPHERIC BOUNDARY LAYER AND TURBULENCE **c47**
S. P. S. Arya *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 21-27 refs (For availability see N78-25473 16-42)
(Grant EPA-R-804653-01-1)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

A brief review of the role of the planetary boundary layer (PBL) is given together with a mention of instruments for measuring its structure. PBL experiments and recent progress in its modeling are discussed. The effect of turbulence on the PBL is also considered. A syllabus for the teaching of PBL aspects is included. ESA

N78-25476 World Meteorological Organization, Geneva (Switzerland).
AIR POLLUTION MONITORING AND THE WMO BACKGROUND AIR POLLUTION MONITORING NETWORK **c45**
G.W. Kronebach and R. E. Munn *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 31-41 (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

The actions within WMO that led to the establishment and development of a program for atmospheric pollution monitoring are outlined. The program itself, which consists of a global network of background air pollution stations, is described. The training requirements for the program, including a draft syllabus, are also presented. ESA

N78-25477 World Meteorological Organization, Geneva (Switzerland)
A SPECIAL ATMOSPHERIC POLLUTANT: THE PARTICULATE LOADING **c45**
E. Meszaros *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 42-52

refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

The concentration and size distribution of background aerosol particles in the troposphere are discussed together with their chemical composition. The formation and renewal of atmospheric aerosol particles are also briefly noted. The problems of tracking related to the physical and chemical properties of aerosol particles are considered and a syllabus is proposed. ESA

N78-25478 World Meteorological Organization, Geneva (Switzerland).
SITING PROBLEMS FOR BACKGROUND AIR POLLUTION MONITORING STATIONS **c45**
A. Koehler *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 53-58 (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

The prerequisites for a regional background air pollution monitoring site are reviewed. These cover such aspects as climatological conditions, soil nature, availability of electric energy and no sources or sinks for pollutants. A syllabus for training in matters of siting and sampling is included. ESA

N78-25479 World Meteorological Organization, Geneva (Switzerland).
ESTABLISHMENT OF BACKGROUND AIR POLLUTION MONITORING STATIONS AND PROBLEMS RELATED TO SAMPLING AND INSTRUMENTATION **c45**
A. Koehler *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 61-74 (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

Factors in the establishment of a sampling station are summarized. These include the physical preparation of the sampling field, protection against unauthorized access, provision of electric cable connectors, installations of monitoring equipment and maintenance and security precautions. Sampling considerations are also reviewed, including classification of quantities to be sampled, interference in sampling, standardization, sampling height, and sampling procedures. Definitions of terms used in sampling are listed and a syllabus for training in the establishment of stations and sampling techniques is proposed. ESA

N78-25480 World Meteorological Organization, Geneva (Switzerland).
METEOROLOGICAL INSTRUMENTS: THEIR SELECTION AND USE IN AIR POLLUTION STUDIES **c47**
Daniel A. Mazzarella *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 75-102 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

The background to air pollution monitoring and its historical development are presented. A checklist for selecting and using instruments particularly for wind velocity and temperature measurement is given. Current trends in instrumentation for pollution studies are reviewed and the requirements for training a meteorological instrument for air pollution are listed. ESA

N78-25481 World Meteorological Organization, Geneva (Switzerland).
AIR QUALITY MONITORING IN LATIN AMERICA AND THE CARIBBEAN **c45**
Ricardo Haddad *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 103-120 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

A summary is presented of an international air quality monitoring network, including data collected, trends, methods used, rationale behind their selection and some of the difficulties encountered. Future development and operating alternatives are discussed. A summary of other programs being implemented in different countries is also presented. Syllabi for training meteorological personnel in atmospheric pollution are given. ESA

N78-25482 World Meteorological Organization, Geneva (Switzerland).
THE ROLE OF THE METEOROLOGIST IN THE AIR QUALITY MANAGEMENT PROCESS **c45**
James L. Dicke *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 123-145 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

Elements of an air resource management program are outlined and factors to be considered in developing air quality criteria, guides and standards are listed. The place of meteorology in the air pollution cycle is described and the duties, skills and knowledge of air pollution meteorologists are reviewed. A short course study on air pollution training is given and annexes include examples of duties, minimum qualifications, and relevant skills etc. for various classes of air pollution control meteorologists. ESA

N78-25483 World Meteorological Organization, Geneva (Switzerland).
THE METEOROLOGICAL ASPECTS OF PLANT INJURY BY AIR POLLUTION **c47**
E. I. Mukammal *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 146-156 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

The effects of pollutants on plant growth and yield, and hence, on agriculture are discussed. Sources and sinks of pollutants are reviewed and the meteorological application of pollutant transport to plant cover is considered. The problems in determining the injury dose to plants are described and meteorology as an aid in damage evaluation and reduction is noted. Educational needs relating to plant injury by air pollution are presented. ESA

N78-25484 World Meteorological Organization, Geneva (Switzerland).
METEOROLOGICAL ASPECTS OF LOCAL AND URBAN AIR POLLUTION WITH SPECIAL CONSIDERATION OF ENERGY PRODUCTION AND CONSUMPTION **c45**
J. M. Giovannoni and A. Junod *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 157-193 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

Two case studies serving to document points for a syllabus for the training of air pollution meteorologists are presented in addition to general remarks and discussions about topics regarding educational requirements. The case studies present problems of urban air pollution in Lausanne (Switzerland) due to district heating and electricity producing thermal plants and the dispersion of fluorine from an aluminum plant in rural Martigny (Switzerland). ESA

N78-25485 World Meteorological Organization, Geneva (Switzerland).
GLOBAL AIR POLLUTION **c45**
R. E. Munn *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 197-214 refs (For availability see N78 25473 16 42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

Seven reasons for studying global air pollution are listed and world patterns of atmospheric pollution are identified. The information required to construct global models of atmospheric pollution is discussed and different models are described. The implications for education and training are summarized. ESA

N78-25486 World Meteorological Organization, Geneva (Switzerland).
TRANSPORT AND DISPERSION OF AIR POLLUTION ON A REGIONAL SCALE **c45**
Antii Kulmala *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 215-228 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

A brief description is given of the OECD project for long-range transport of air pollutants (LRTAP). Essential parts of the LRTAP program are described including emission surveys, dispersion models with verification experiments, precipitation and air sampling of sulphur compounds, transformation considerations and data evaluation. Potential topics for training and educational requirements are summarized. ESA

N78-25487 World Meteorological Organization, Geneva (Switzerland).
ATMOSPHERIC DIFFUSION FUNDAMENTALS FOR AIR POLLUTION APPLICATIONS **c46**
F. A. Gifford, Jr. *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 229-240 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

Following a description of the role played by the atmospheric boundary layer in controlling air pollution, the theory and parameterization of atmospheric diffusion are discussed. Diffusion in exceptional flows, such as over cities, water, complex terrain etc., is summarized together with diffusion modeling in air pollution applications. A course in the meteorology of air pollution is outlined. ESA

N78-25488 World Meteorological Organization, Geneva (Switzerland).
ON AIR-BORNE TRANSPORT OF SULPHUR OVER THE NORTH ATLANTIC **c45**
Alf Nyberg *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 241-253 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

The emission and fall-out of sulfur dioxide over Europe, particularly Scandinavia, and the role of the long-range transport of sulfur from the United States are discussed. The collection and analysis of precipitation samples are described and the results are discussed. The conclusion reveals that air coming from N. America will contain excess sulfur when arriving in Europe and that the fall-out in Scandinavia is higher than that in Central Europe. ESA

N78-25489 World Meteorological Organization, Geneva (Switzerland).
TURBULENT DIFFUSION **c46**
A. S. Zaitsev *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 259-271 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

The present state of knowledge and the prospects for development of that area of atmospheric physics relating to turbulent diffusion is described. The discussion forms the basis of a syllabus for the training of meteorological personnel in turbulent diffusion. ESA

N78-25490 World Meteorological Organization, Geneva (Switzerland).
AIR POLLUTION POTENTIAL FORECASTING **c45**
Richard L. Bailey *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 272-275 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

The forecasting of changes of air quality (air pollution potential) are discussed and the procedures employed by the US National Weather Service to estimate and model regional pollutant dispersion conditions are outlined. Examples of synoptic situations that are favorable in restricting dispersion conditions are given and other parameters required in the forecasting are summarized. A minimum curriculum for air pollution training is suggested. ESA

N78-25491 World Meteorological Organization, Geneva (Switzerland).
EXAMPLES OF THE VISUALIZATION OF METEOROLOGICAL PROCESSES RELEVANT TO AIR POLLUTION DYNAMICS AND FORECASTING **c45**
Guenter Warnecke *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 276-288 (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

The philosophy of a program for the development of visual training aids for use in meteorology is outlined and problems and methods in visualizing atmospheric processes are reviewed. The fundamentals of a syllabus for teaching A/V meteorology are summarized and examples of instrumental motion pictures are given. In addition, a description of the West-Berlin sulfur dioxide network is presented as a visualization aid. ESA

N78-25492 World Meteorological Organization, Geneva (Switzerland).
METEOROLOGICAL ASPECTS OF ENVIRONMENTAL IMPACT ASSESSMENT **c47**
James L. Dicke *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 289-309 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

A framework for preparing environmental assessments, emphasizing meteorological aspects, is proposed. The fundamental Impact Statement Process in the USA is described in detail and definition of the codes for the general nature of EPA comments. Meteorological assessment techniques necessary are outlined together with meteorological considerations pertinent to evaluating the air pollution impact of a pollutant source. ESA

N78-25493 World Meteorological Organization, Geneva (Switzerland).
THE URBAN ATMOSPHERE AS AN ENVIRONMENT FOR AIR POLLUTION DISPERSION **c45**
T. R. Oke *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 316-341 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

The general state of knowledge concerning features of the urban atmosphere which have a bearing upon pollutant dispersion is reviewed. Features of any atmosphere exerting a control on dispersion are identified and the effects of a city upon these controls are summarized. The relationship between urban meteorology and urban air pollution patterns is illustrated. A syllabus for the education and training of meteorological personnel in air pollution meteorology with special reference to urban content is suggested. ESA

N78-25494 World Meteorological Organization, Geneva (Switzerland).
STRATOSPHERIC POLLUTION **c45**
J. P. Friend *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 342-350 (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

Outline notes are given under the following headings: impacts upon radiation; effects of concern; assessing stratospheric perturbations; equations of continuity; transport terms; chemical reaction terms; resources needed. The bones of a course on stratospheric pollution are also given. ESA

N78-25495 World Meteorological Organization, Geneva (Switzerland).
THE EFFECT OF ATMOSPHERIC POLLUTION ON CLIMATE **c47**
O. P. Petrenchuk and K. A. Hzmaljan *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 351-372 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

Carbon dioxide as a climate-forming factor is discussed and its influence on the atmospheric thermal regions is considered. The effect of aerosols on climatic change are similarly treated and their main characteristics reviewed. Urban air pollution and the effect of pollutants on the ozone layer of the stratosphere are discussed. Syllabi for the education and training of meteorological personnel in atmospheric pollution effects on climate and environment protection are suggested. ESA

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N78-25496*# Cornell Univ., Ithaca, N. Y. Remote Sensing Program.
CORNELL UNIVERSITY REMOTE SENSING PROGRAM Semiannual Status Report, 1 Dec. 1977 - 31 May 1978

Ta Liang, Arthur J. McNair, and Warren R. Philipson, Principal Investigators Jun. 1978 260 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NGL-33-010-171)
(E78-10130; NASA-CR-157004; SASR-12) Avail: NTIS HC A12/MF A01 CSCL 08B

The author has identified the following significant results. Available aerial photographs were used to characterize mosquito breeding sites in Oswego County, New York. Numerous wetlands are contained within this county; this area is the only inland area in North America to have confirmed outbreaks of eastern equine encephalitis. This photocharacterization of primary mosquito breeding sites will be used to develop effective spraying. Large scale color and color infrared aerial photographs were used to assess changes in aquatic vegetation that accompanied phosphorus reduction in an eutrophic lake in New York.

N78-25497*# Department of the Environment, Ottawa (Ontario).
RETRANSMISSION OF HYDROMETRIC DATA IN CANADA Quarterly Report, Jan. - Mar. 1978
R. A. Halliday, Principal Investigator and I. A. Reid May 1978 9 p ref Sponsored by NASA ERTS
(E78-10131; NASA-CR-157144) Avail: NTIS HC A02/MF A01 CSCL 08H

The author has identified the following significant results. The project continues to demonstrate the feasibility of transmitting hydrometric data in the LANDSAT and GOES mode and using these data operationally. All elements except for the GOES downlink at PASS are functioning well.

N78-25498*# Ministry of Tourism and Wildlife, Nairobi (Kenya).
THE KENYA RANGELAND ECOLOGICAL MONITORING UNIT
W. E. Stevens, Principal Investigator 15 Feb. 1978 17 p refs Sponsored by NASA ERTS
(E78-10132; NASA-CR-157011) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. Methodology for aerial surveys and ground truth studies was developed, tested, and revised several times to produce reasonably firm methods of procedure. Computer programs were adapted or developed to analyze, store, and recall data from the ground and air monitoring surveys.

N78-25499*# Columbia Univ., New York. Dept. of Geography.
APPLICATION OF DIGITAL ANALYSIS OF MSS DATA TO AGROENVIRONMENTAL STUDIES Semiannual Progress Report
Kempton E. Webb, Colin J. High, and Jerry C. Coiner, Principal Investigators 1 Sep. 1977 111 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NsG-5080)
(E78-10133; NASA-CR-157145) Avail: NTIS HC A06/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N78-25500*# Texas A&M Univ., College Station. Remote Sensing Center.
DRYLAND PASTURE AND CROP CONDITIONS AS SEEN BY HCMM Progress Report, Jan. - Apr. 1978
W. D. Rosenthal, J. C. Harlan, and B. J. Blanchard, Principal Investigators Apr. 1978 20 p refs ERTS
(E78-10134; NASA-CR-157146; RSC-3712-1) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N78-25501*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
APPLICATIONS OF HCMM SATELLITE DATA TO THE STUDY OF URBAN HEATING PATTERNS Quarterly Report
Toby N. Carlson, Principal Investigator 1 Jun. 1978 8 p refs ERTS
(Contract NAS5-24264)
(E78-10135; NASA-CR-157147; QR-2) Avail: NTIS HC A02/MF A01 CSCL 13B

There are no author-identified significant results in this report.

N78-25502*# Alaska Univ., Fairbanks.
LANDSAT SURVEY OF NEAR-SHORE ICE CONDITIONS ALONG THE ARCTIC COAST OF ALASKA Final Report
William J. Stringer, Principal Investigator and Stephen A. Barrett 31 May 1978 211 p refs Sponsored by NASA ERTS
(E78-10136; NASA-CR-157148) Avail: NTIS HC A10/MF A01 CSCL 08L

The author has identified the following significant results. Winter and spring near-shore ice conditions were analyzed for the Beaufort Sea 1973-77, and the Chukchi Sea 1973-76. LANDSAT imagery was utilized to map major ice features related to regional ice morphology. Significant features from individual LANDSAT image maps were combined to yield regional maps of major ice ridge systems for each year of study and maps of flaw lead systems for representative seasons during each year. These regional maps were, in turn, used to prepare seasonal ice morphology maps. These maps showed, in terms of a zonal analysis, regions of statistically uniform ice behavior. The behavorial characteristics of each zone were described in terms of coastal processes and bathymetric configuration.

N78-25503*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
REQUIREMENTS OF A GLOBAL INFORMATION SYSTEM FOR CORN PRODUCTION AND DISTRIBUTION Final Report
D. A. Landgrebe, Principal Investigator, M. F. Baumgardner, M. E. Bauer, M. A. Martin, and R. M. Peart Nov. 1977 120 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-14970)
(E78-10137; NASA-CR-157153; T-1314/4; MA-129TA) Avail: NTIS HC A06/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N78-25504*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
RESEARCH IN REMOTE SENSING OF AGRICULTURE, EARTH RESOURCES, AND MAN'S ENVIRONMENT Quarterly Report, 1 Mar. - 31 May 1978
D. A. Landgrebe, Principal Investigator 31 May 1978 113 p refs EREP
(Contract NAS9-15466)
(E78-10138; NASA-CR-157154; LARS-053178) Avail: NTIS HC A06/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N78-25505*# Georgia Southwestern Coll., Americus.
REMOTE SENSING OF GEOBOTANICAL RELATIONS IN GEORGIA Final Technical Report
Daniel D. Arden, Jr. and Raymond N. Westra Jan. 1977 103 p refs
(Contract NAS8-30884)
(NASA-CR-150709) Avail: NTIS HC A06/MF A01 CSCL 08F

The application of remote sensing to geological investigations, with special attention to geobotanical factors, was evaluated. The general areas of investigation included: (1) recognition of mineral deposits; (2) geological mapping; (3) delineation of geological structure, including areas of complex tectonics; and (4) limestone areas where ground withdrawal had intensified surface collapse. Author

N78-25506*# Marine Environmental Sciences Consortium, Dauphin Island, Ala.
MOBILE BAY TURBIDITY STUDY Final Report, 1 Apr. 1976 - 31 Sep. 1977
George F. Crozier (South Alabama Univ.) and William W. Schroeder

(Alabama Univ., University) May 1978 60 p refs
(Contract NAS8-30810)
(NASA-CR-150711) Avail: NTIS HC A04/MF A01 CSCL 08J

The termination of studies carried on for almost three years in the Mobile Bay area and adjacent continental shelf are reported. The initial results concentrating on the shelf and lower bay were presented in the interim report. The continued scope of work was designed to attempt a refinement of the mathematical model, assess the effectiveness of optical measurement of suspended particulate material and disseminate the acquired information. The optical characteristics of particulate solutions are affected by density gradients within the medium, density of the suspended particles, particle size, particle shape, particle quality, albedo, and the angle of refracted light. Several of these are discussed in detail. Author

N78-25507*# Washington Univ., St. Louis, Mo. Center for Development Technology.
PROGRAM ON STATE AGENCY REMOTE SENSING DATA MANAGEMENT (SARSDM) Final Report
Lester F. Eastwood, Jr. and Edward O. Gotway 19 May 1978 208 p refs
(Contract NAS8-32354)
(NASA-CR-150715) Avail: NTIS HC A10/MF A01 CSCL 05B

A planning study for developing a Missouri natural resources information system (NRIS) that combines satellite-derived data and other information to assist in carrying out key state tasks was conducted. Four focal applications -- dam safety, ground water supply monitoring, municipal water supply monitoring, and Missouri River basin modeling were identified. Major contributions of the study are: (1) a systematic choice and analysis of a high priority application (water resources) for a Missouri, LANDSAT-based information system; (2) a system design and implementation plan, based on Missouri, but useful for many other states; (3) an analysis of system costs, component and personnel requirements, and scheduling; and (4) an assessment of deterrents to successful technological innovation of this type in state government, and a system management plan, based on this assessment, for overcoming these obstacles in Missouri. Author

N78-25508*# Tennessee Univ., Knoxville. Dept. of Geography.
THE VERIFICATION OF LANDSAT DATA IN THE GEOGRAPHICAL ANALYSIS OF WETLANDS IN WEST TENNESSEE Final Report, 31 Oct. 1974 - 31 Mar. 1978
John Rehder and Dale Quattrochi Jun. 1978 144 p refs
(Contract NAS8-31143)
(NASA-CR-3012) Avail: NTIS HC A07/MF A01 CSCL 08F

The reliability of LANDSAT imagery as a medium for identifying, delimiting, monitoring, measuring, and mapping wetlands in west Tennessee was assessed to verify LANDSAT as an accurate, efficient cartographic tool that could be employed by a wide range of users to study wetland dynamics. The verification procedure was based on the visual interpretation and measurement of multispectral imagery. The accuracy testing procedure was predicated on surrogate ground truth data gleaned from medium altitude imagery of the wetlands. Fourteen sites or case study areas were selected from individual 9 x 9 inch photo frames on the aerial photography. These sites were then used as data control calibration parameters for assessing the cartography accuracy of the LANDSAT imagery. An analysis of results obtained from the verification tests indicated that 1:250,000 scale LANDSAT data were the most reliable scale of imagery for visually mapping and measuring wetlands using the area grid technique. The mean areal percentage of accuracy was 93.54 percent (real) and 96.93 percent (absolute). As a test of accuracy, the LANDSAT 1:250,000 scale overall wetland measurements were compared with an area cell mensuration of the swamplands from 1:130,000 scale color infrared U-2 aircraft imagery. The comparative totals substantiated the results from the LANDSAT verification procedure. Author

N78-25509# Minnesota Univ., Minneapolis.
ASSESSMENT OF WATER QUALITY STATUS AND TRENDS IN MINNESOTA BY REMOTE SENSING TECHNIQUES
Kenneth N. Brooks, Arnett C. Mace, Jr., and Merle P. Meyer Dec. 1977 66 p refs
(PB-277822; W78-04105) Avail: NTIS HC A04/MF A01 CSCL 08H

Aerial photography, with limited field sampling, was investigated as a practical alternative to estimate the water quality of ten lakes in the Minneapolis and St. Paul metropolitan area of Minnesota. These ten lakes represented a wide diversity of trophic state and were sampled for color, turbidity, suspended sediment, chlorophyll, phytoplankton numbers, and Secchi disk depth. Regression equations for these water quality indicators were based on film transmittance of black and white panchromatic (2402), color (2448) and color infrared (2443) films as measured with a VP-8 image analyzer. Statistically significant prediction equations were developed for Secchi disk depth, turbidity and color. Variability of transmittance readings with time required that a specific set of procedures be followed for practical application. Procedures are outlined which allow film transmittance to be used to estimate Carlson's Trophic State Index. GRA

N78-25510# Gary Operating Co., Englewood, Colo.
PILOT DEMONSTRATION-ENHANCED OIL RECOVERY BY MICELLAR-POLYMER WATERFLOODING BELL CREEK FIELD Monthly Technical Progress Report, Aug. 1977
10 Sep. 1977 22 p refs
(Contract EX-76-C-01-2237)
(COO-4207-14; MTPR-14) Avail: NTIS HC A02/MF A01

This fourteenth Monthly Technical Progress Report describes tasks for: Micellar-polymer systems selection and evaluation; site development; pilot performance predictions, and fluid distribution facilities. The major activity at this time is Phase 2, Task 1, the Micellar-polymer systems selection as between two competing designs being developed. ERA

N78-25511# Tulsa Univ., Okla.
PULSE TEST ANALYSIS OF VERTICALLY FRACTURED WELLS M.S. Thesis. Final Report, 1 Feb. 1976 - 30 Jun. 1977
R. Raghaven 1977 214 p refs
(Contract EY-76-S-21-8036)
(ORO-8036-5) Avail: NTIS HC A10/MF A01

Generalized correlations are presented whereby an engineer may easily analyze and/or design pulse tests in fractured wells from pulse tests. The results of the study can be used to obtain the compass orientation of a vertical fracture as well as the degree of reservoir anisotropy by pulse tests provided the formation permeability and fracture half-length are known. These two parameters may be easily obtained from a pressure test at the fractured well by type curve matching. This pressure test may be conducted subsequent to the pulse test or during the pulse test. If the formation permeability is known, then the results may be used to determine fracture half-length and compass orientation. Procedures to obtain the desired results are discussed in an example. The results can also be used to design pulse tests. Conditions necessary to insure that the response obtained is maximum are described. ERA

N78-25512# Brandywine Associates, Bellport, N. Y.
LAND USE CONFIGURATIONS AND THE UTILIZATION OF DISTRIBUTED ENERGY TECHNOLOGY Final Report
30 Sep. 1977 64 p refs
(Contract W-7405-eng-48)
(UCRL-13773) Avail: NTIS HC A04/MF A01

The feasibility of future development is considered in which energy systems utilizing distributed technologies are employed to meet state energy demands. Distributed technologies were defined as favoring the use of renewable, small scale energy support systems. Land use was viewed both as a factor which limits the use of such systems and as providing a set of institutional mechanisms for aiding their utilization. Land use was treated in the context of development on a community and regional scale to take place over a period of approximately 50 years. ERA

N78-25513# Booz-Allen and Hamilton, Inc., Bethesda, Md. Development Research Div.
INTERACTION OF LAND-USE PATTERNS AND RESIDENTIAL ENERGY CONSERVATION
25 May 1977 212 p refs Sponsored in part by DOE and FEA

(TID-28058) Avail: NTIS HC A10/MF A01

The purpose of this report to evaluate the relationships between land-use patterns, energy consumption, and public land use policies is studied. The major objectives of the research program are to: (1) provide empirical data on energy consumption for various configurations of single- and multi-family residential units in relation to their location within an urban area; (2) evaluate the potential short term public land use policy options and their subsequent savings in energy consumption; and (3) identify and prioritize future data and research needs in the fields of land use and energy consumption relationships within urbanized areas. Primary energy consumption data were collected for 4 neighborhoods each in the SMSA's of Tucson, Washington, D.C., and Chicago. ERA

N78-25514# Gruy Federal, Inc., Arlington, Va.
OIL AND GAS REPLACEMENT COST: DEVELOPMENT AND PRODUCTION. VOLUME 1: DISCUSSION OF METHODOLOGY, EXHIBITS, AND PROJECTIONS Final Report
5 Aug. 1977 101 p
(Contract FEA-CR-05-60813-00)
(TID-28043/1) Avail: NTIS HC A06/MF A01

The development and production costs by region and well depth interval were projected for the benchmark years 1980, 1985, and 1990. The identification and collection of reliable and consistent historical series disaggregate to these levels are considered essential to the generation of accurate and viable forecasts of replacement costs for oil and gas production systems. Twenty-four geographical regions were specified and six depth classes. A clear delineation is drawn between the cost of drilling and completing development wells and the cost of operating producing wells. Development well costs are projected on a cost per foot basis. Operating costs of producing wells are projected on a cost per month basis. ERA

N78-25515# Gruy Federal, Inc., Arlington, Va.
OIL AND GAS REPLACEMENT COST: DEVELOPMENT AND PRODUCTION. VOLUME 2: EXHIBITS Final Report
5 Aug. 1977 294 p
(Contract FEA-CR-05-60813-00)
(TID-28043/2) Avail: NTIS HC A13/MF A01

Data tables are presented relative to the replacement cost of petroleum and natural gas in the USA for the benchmark years 1980, 1985, and 1990. ERA

N78-25516# California Univ., Riverside.
TRACE METAL SPECIATION IN SALINE WATERS AFFECTED BY GEOTHERMAL BRINES
Garrison Sposito and A. L. Page Nov. 1977 121 p refs
(Contract W-7405-eng-48)
(UCRL-13790) Avail: NTIS MF A01

A description is given of the chemical equilibrium computer program GEOCHEM, which was developed to calculate trace element speciation in soil, irrigation, drainage, or Salton Sea waters affected by geothermal brine. GEOCHEM is applied to irrigation water brine mixtures and to Salton Sea water brine mixtures in order to compute the chemical speciation of the elements Cd, Cu, Hg, Ni, Pb, and Zn, along with the oxyanions of As and B. The results suggest that the computer simulation can have an important effect on a program for managing brine spills. ERA

N78-25517# Minnesota Geological Survey, St. Paul.
DESIGN OF A GROUNDWATER SAMPLING NETWORK FOR MINNESOTA
Roman Kanivetskiy 4 Nov. 1977 44 p refs Prepared in cooperation with Bendix Field Eng. Corp., Columbia, Md.
(Contract EY-76-C-13-1664)
(GJBX-1(78)) Avail: NTIS HC A03/MF A01

A folio was compiled to facilitate the use of groundwater as a sampling medium to aid in exploration for hitherto undiscovered deposits of uranium in the subsurface rocks of Minnesota. The report consists of the following sheets of the hydrogeologic map of Minnesota: (1) map of bedrock hydrogeology, (2) generalized cross sections of the hydrogeologic map of Minnesota, showing both Quaternary deposits and bedrock, (3) map of water wells that penetrate Precambrian rocks in Minnesota. A list of these wells, showing locations, names of owners, type of Precambrian aquifers penetrated, lithologic material of the aquifers, and well depths is provided. Structural settings, locations, and composition of the bedrock aquifers, movement of groundwater, and preliminary suggestions for a sampling program are discussed. ERA

N78-25518# Indiana Univ., Bloomington.
CARBONACEOUS SHALES OF INDIANA AS SOURCES OF ENERGY, PETROCHEMICALS, AND CERAMIC MATERIALS Quarterly Technical Progress Report, Oct. - Dec. 1977
1977 11 p
(Contract EY-76-C-05-5204)
(TID-28179) Avail: NTIS HC A02/MF A01

Activities during the report period include selection of drill site locations and compilation of three west-to-east cross sections of the New Albany shale equivalents in the Michigan basin. Work is also reported on isopach maps of lithologic units in the New Albany shale interval. ERA

N78-25519# City of Long Beach, Calif.
PILOT DEMONSTRATION OF ENHANCED OIL RECOVERY BY MICELLAR POLYMER WATERFLOODING, PHASE B Quarterly Report, 1977
James E. Wade and H. L. Staub 24 Oct. 1977 16 p
(Contract EF-77-C-03-1395)
(SAN/1395-14; QR-3) Avail: NTIS HC A02/MF A01

A field test to demonstrate an improved oil recovery process which will displace economic quantities of otherwise non-recoverable viscous oil from the Wilmington oil field, as well as to determine its suitability for application to other sites is presented. Favorable preliminary results on core-flood tests were obtained using a sulfonate formulated from Wilmington crude oil. ERA

N78-25520# Geological Survey, Champaign, Ill. Water Resources Div.
FREQUENCY ANALYSIS OF ILLINOIS FLOODS USING OBSERVED AND SYNTHETIC STREAMFLOW RECORDS Final Report
George W. Curtis Jul. 1977 40 p refs Sponsored in part by Illinois State Dept. of Transportation
(PB-277350; USGS-WRI-77-104; USGS-WRD-WRI-78-008) Avail: NTIS HC A03/MF A01 CSCL 08H

Equations, applicable statewide, for estimating flood magnitudes having recurrence intervals ranging from 2 to 500 years for unregulated rural streams, with drainage areas ranging from 0.02 to 10,000 square miles (0.05 to 25,900 square kilometers), were derived by multiple regression analyses. A rain fall-runoff model was used in the synthesis of long-term annual peak data for each of 54 small watersheds. Synthetic frequency curves generated from five long-term precipitation stations were combined into one synthetic curve and then this synthetic curve was combined with the observed station frequency curve to define the station frequency curve. Synthetic data from the 54 small stream, observed data at 33 small streams, and observed data at 154 large streams were used in the analyses. The most significant independent variables in the regression analysis for estimating flood peaks on Illinois streams were drainage area, slope, rainfall intensity, and an areal factor. Author

N78-25521# Coastal Environments, Inc., Baton Rouge, La.
CULTURAL RESOURCES EVALUATION OF THE NORTHERN GULF OF MEXICO CONTINENTAL SHELF. VOLUME 1: PREHISTORIC CULTURAL RESOURCE POTENTIAL
Sherwood Gagliano 1977 386 p refs
(PB-276773) Avail: NTIS HC A17/MF A01 CSCL 08C

The predictability of drowned prehistoric habitation sites in the continental shelf area, northern Gulf of Mexico, from the Rio Grande River to the Florida Keys is discussed. A method is presented of forming hypotheses about the nature of the archeological possibilities of the OCS that can be tested with the limited sort of data that was gathered. The archeological literature of the land areas will be reviewed to identify major cultural manifestations, by time and by type. An inventory is made of the known sites in the Northern Gulf area that were occupied from 55,000 B.P. to 3,500 B.P. Age, ecofacts, artifacts,

and associated landforms of these typical sites are discussed. GRA

N78-25522# Coastal Environments, Inc., Baton Rouge, La.
CULTURAL RESOURCES EVALUATION OF THE NORTHERN GULF OF MEXICO CONTINENTAL SHELF. VOLUME 2: HISTORICAL CULTURAL RESOURCES
Sherwood Gagliano Feb. 1978 181 p refs
(PB-276774) Avail: NTIS HC A09/MF A01 CSCL 08C
For abstract, see N78-25521.

N78-25523# Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
SUITABILITY OF FLUOROCARBONS AS TRACERS IN GROUND WATER RESOURCES EVALUATION
J. Randall, T. Schultz, and S. Davis Nov. 1977 42 p refs
(Contract DI-14-34-0001-7006; OWRT Proj. A-063-ARIZ(1))
(PB-277488; W78-03967) Avail: NTIS HC A03/MF A01 CSCL 08H

Trichlorofluoromethane (F-11) and Dichlorodifluoromethane (F-12) are artificially produced compounds present in the modern atmosphere. They are slightly soluble in water and can be detected in all surface waters and recently recharged ground water. Because atmospheric concentrations of these compounds have increased rapidly during the past 35 years, equilibrium concentrations in water recharged into the subsurface have also increased. Therefore, F-11 and F-12 concentrations can be used to estimate groundwater age if younger than about 35 years. Furthermore, because F-11 and F-12 have been introduced into the atmosphere at different rates, the ratio of the concentrations of these compounds has changed with time and can also be used to estimate the age of the water. F-11 and F-12 were detected in ground water from Arizona and Texas. A field-operable electron-capture gas chromatograph was constructed for field use, allowing repetitive in situ measurements, thus reducing sample contamination. Results on dating of water were very encouraging. Author

N78-25524# Washington State Univ., Pullman. Charles W. Harris Hydraulics Lab.
WATER RESOURCES MANAGEMENT AND PLANNING: OPTIMIZATION MODELING OF RESERVOIR SYSTEMS
M. H. Houck and B. R. Cleland Oct. 1977 76 p refs
(OWRT Proj. A-086-WASH(1))
(PB-277821; W78-04106; TR-54) Avail: NTIS HC A05/MF A01 CSCL 08H

The class of optimization models which can be used as tools by the water resource planner or manager is examined. Models are described and discussed in terms of their mathematical structure, computational burden or cost of solution, method of incorporating the stochastic nature of streamflows, ability to identify general optimal operating policies, and ability to identify optimal reservoir system designs. GRA

N78-25525# Oregon State Univ., Corvallis. Dept. of Forest Engineering.
HYDROLOGIC FACTORS AND ENVIRONMENTAL IMPACTS OF MASS SOIL MOVEMENTS IN THE OREGON COAST RANGE
Gary Ketcheson and Henry A. Froehlich Jan. 1978 106 p refs
(Contract DI-14-34-0001-7078; OWRT Proj. A-040-ORE(1))
(PB-277710; W78-04365) Avail: NTIS HC A06/MF A01 CSCL 08H

Mass soil movements of four types: debris avalanche, debris torrent, debris slide and bank slough, were field inventoried in the Oregon Coast Range. The results are compared with other studies in the Pacific Northwest and the differences are discussed. Natural variation accounts for much of the differences. Guidelines are given for assessing the risk of damage by debris avalanche and torrent type failures in proposed timber harvest areas. GRA

N78-25526# National Academy of Sciences - National Research Council, Washington, D. C. Commission on Natural Resources.
OCS OIL AND GAS: AN ASSESSMENT OF THE DEPARTMENT OF THE INTERIOR ENVIRONMENTAL STUDIES PROGRAM
18 Feb. 1978 119 p refs
(Contract DI-AA550-CT6-30)
(PB-277493) Avail: NTIS HC A06/MF A01 CSCL 08G
The concepts, procedures, and results of the Department of Interior

The concepts, procedures, and results of the Department of interior Environmental Studies Program were examined in order to provide an evaluation and some recommendations that the Department could use as a basis for improvement of the program. The program and the actual or potential use of the results. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N78-25527* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLAR CELL COLLECTOR Patent
John C. Evans, Jr., inventor (to NASA) Issued 4 Apr. 1978 5 p Filed 22 Feb. 1977 Supersedes N77-17564 (15 - 08, p 1052)
(NASA-Case-LEW-12552-1; US-Patent-4,082,569; US-Patent-Appl-SN-770869; US-Patent-Class-136-89CC; US-Patent-Class-357-30; US-Patent-Class-357-65; US-Patent-Class-357-67; US-Patent-Class-29-572; US-Patent-Class-427-75; US-Patent-Class-427-261) Avail: US Patent Office CSCL 10A

A method is provided for the fabrication of a photovoltaic device which possesses an efficient collector system for the conduction of the current generated by incident photons to the external circuitry of the device.
Official Gazette of the U.S. Patent Office

N78-25528* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF MAKING ENCAPSULATED SOLAR CELL MODULES Patent
Evelyn Anagnostou and Americo F. Forestieri, inventors (to NASA) Issued 11 Apr. 1978 4 p Filed 30 Nov. 1976 Supersedes N77-15490 (15 - 06, p 0769)
(NASA-Case-LEW-12185-1; US-Patent-4,083,097; US-Patent-Appl-SN-746269; US-Patent-Class-29-572; US-Patent-Class-29-628; US-Patent-Class-136-89P; US-Patent-Class-136-89H) Avail: US Patent Office CSCL 10A

Electrical connections to solar cells in a module are made at the same time the cells are encapsulated for protection. The encapsulating material is embossed to facilitate the positioning of the cells during assembly.
Official Gazette of the U.S. Patent Office

N78-25529* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD FOR PRODUCING SOLAR ENERGY PANELS BY AUTOMATION Patent
John C. Evans, Jr., inventor (to NASA) Issued 18 Apr. 1978 11 p Filed 25 Apr. 1977 Supersedes N77-22615 (15 - 13, p 1744)
(NASA-Case-LEW-12541-1; US-Patent-4,084,985; US-Patent-Appl-SN-790637; US-Patent-Class-136-89P; US-Patent-Class-29-572; US-Patent-Class-136-89H; US-Patent-Class-136-89CC; US-Patent-Class-156-633) Avail: US Patent Office CSCL 10A

A solar cell panel was fabricated by photoetching a pattern of collector grid systems with appropriate interconnections and bus bar tabs into a glass or plastic sheet. These regions were then filled with a first, thin conductive metal film followed by a layer of a mixed metal oxide, such as InAsO or InSnO. The multiplicity of solar cells were bonded between the protective sheet at the sites of the collector grid systems and a back

electrode substrate by conductive metal filled epoxy to complete the fabrication of an integrated solar panel.
Official Gazette of the U.S. Patent Office

N78-25530* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INORGANIC-ORGANIC SEPARATORS FOR ALKALINE BATTERIES Patent
Dean W. Sheibley, inventor (to NASA) Issued 18 Apr. 1978 4 p Filed 7 Sep. 1976 Supersedes N76-31674 (14 - 22, p 2890)
(NASA-Case-LEW-12649-1; US-Patent-4,085,241; US-Patent-Appl-SN-720521; US-Patent-Class-427-385B; US-Patent-Class-427-385C; US-Patent-Class-429-254) Avail: US Patent Office CSCL 10C

A flexible separator is reported for use between the electrodes of Ni-Cd and Ni-Zn batteries using alkaline electrolytes. The separator was made by coating a porous substrate with a battery separator composition. The coating material included a rubber-based resin copolymer, a plasticizer and inorganic and organic fillers which comprised 55% by volume or less of the coating as finally dried. One or more of the filler materials, whether organic or inorganic, is preferably active with the alkaline electrolyte to produce pores in the separator coating. The plasticizer was an organic material which is hydrolyzed by the alkaline electrolyte to improve conductivity of the separator coating. Official Gazette of the U.S. Patent Office

N78-25531* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD AND APPARATUS FOR CONDITIONING OF NICKEL-CADMIUM BATTERIES Patent
Robert E. Kapustka, inventor (to NASA) Issued 11 Apr. 1978 5 p Filed 24 Nov. 1976 Supersedes N77-12511 (15 - 03, p 0353)
(NASA-Case-MFS-23270-1; US-Patent-4,084,124; US-Patent-Appl-SN-744573; US-Patent-Class-320-9; US-Patent-Class-320-13; US-Patent-Class-320-15; US-Patent-Class-320-32; US-Patent-Class-320-39) Avail: US Patent Office CSCL 10C

A method and apparatus are described for reconditioning batteries utilizing a dc-dc converter. During a discharge of the batteries, each cell is monitored by the converter. When the voltage of a cell decreases to a predetermined level, a converter will assume the load of this cell and inhibit the voltage from reaching zero, thereby preventing voltage reversal of that cell.
Official Gazette of the U.S. Patent Office

N78-25532*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROCEEDINGS OF THE DOE CHEMICAL ENERGY STORAGE AND HYDROGEN ENERGY SYSTEMS CONTRACTS REVIEW
James H. Kelley 15 Feb. 1978 296 p refs Meeting held at Hunt Valley, Md., 16-17 Nov. 1977
(Contracts NAS7-100; EC-77-A-31-1035)
(NASA-CR-157164; JPL-Pub-78-1) Avail: NTIS HC A13/MF A01 CSCL 10C

The background and objectives of thirty-nine hydrogen-related tasks were discussed, the status of the studies or technical effort is shown, and state projected solutions for resolving the identified problems are projected. Author

N78-25533*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COAL DESULFURIZATION BY LOW TEMPERATURE CHLORINOLYSIS, PHASE 1 Final Report, 6 Jul. - 6 Nov. 1977
John J. Kalvinskas, George C. Hsu, John B. Ernest, Duane F. Andress, and Donald R. Feller 23 Nov. 1977 105 p refs Sponsored in part by DOE
(Contract NAS7-100)
(NASA-CR-157172; JPL-Pub-78-8) Avail: NTIS HC A06/MF A01 CSCL 21D

The reported activity covers laboratory scale experiments on twelve bituminous, sub-bituminous and lignite coals, and preliminary design and specifications for bench-scale and mini-pilot plant equipment. Author

N78-25534*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
WIDE AREA DETECTION SYSTEM: CONCEPTUAL DESIGN STUDY Interim Report, Aug. 1976 - May 1977
E. E. Hilbert, C. Carl, W. Goss, G. R. Hansen, M. J. Olsasky, and A. R. Johnston Feb. 1978 191 p refs Sponsored by FHWA
(Contract NAS7-100)
(NASA-CR-157170; JPL-Pub-78-32; FHWA-RD-77-86) Avail: NTIS HC A09/MF A01 CSCL 10A

An integrated sensor for traffic surveillance on mainline sections of urban freeways is described. Applicable imaging and processor technology is surveyed and the functional requirements for the sensors and the conceptual design of the breadboard sensors are given. Parameters measured by the sensors include lane density, speed, and volume. The freeway image is also used for incident diagnosis. Author

N78-25535*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROCESS HEAT IN CALIFORNIA: APPLICATIONS AND POTENTIAL FOR SOLAR ENERGY IN THE INDUSTRIAL, AGRICULTURAL AND COMMERCIAL SECTORS
Rosalyn H. Barbieri, Ralph E. Bartera, E. S. Davis, George E. Hlavka, Donna S. Pivirotto, and Gilbert Yanow Mar. 1978 105 p refs Sponsored in part by Calif. Energy Resources Conservation and Develop. Comm.
(Contract NAS7-100)
(NASA-CR-157169; JPL-Pub-78-33) Avail: NTIS HC A06/MF A01 CSCL 10A

A summary of the results of a survey of potential applications of solar energy for supplying process heat requirements in the industrial, agricultural, and commercial sectors of California is presented. Technical, economic, and institutional characteristics of the three sectors are examined. Specific applications for solar energy are then discussed. Finally, implications for California energy policy are discussed along with recommendations for possible actions by the State of California. Author

N78-25536*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
POTENTIAL FOR COGENERATION OF HEAT AND ELECTRICITY IN CALIFORNIA INDUSTRY, PHASE 1 Final Report
H. S. Davis, R. M. Gurfield, V. C. Moretti, and M. L. Slonski 1 May 1978 179 p Sponsored in part by Calif. Energy Resources Conserv. and Develop. Comm.
(Contract NAS7-100)
(NASA-CR-157168; JPL-Pub-78-42) Avail: NTIS HC A09/MF A01 CSCL 10B

Information collected during an industrial survey of 12 selected plants was organized into four categories: technical, economic, environmental, and institutional. The technical aspects of industrial cogeneration are examined on a site-specific basis. The site-specific economics, environmental constraints, and institutional barriers that impact industrial cogeneration will be further investigated. Author

N78-25537*# General Electric Co., Philadelphia, Pa. Space Div.
PROTOTYPE SOLAR HEATING AND COMBINED HEATING AND COOLING SYSTEMS Quarterly Report, Jul. - Sep. 1976
1 Oct. 1976 116 p Prepared for DoE
(Contract NAS8-32092)
(NASA-CR-150686) Avail: NTIS HC A06/MF A01 CSCL 10A

Eight prototype solar heating and combined heating and cooling systems are considered. This effort includes development, manufacture, test, installation, maintenance, problem resolution, and performance evaluation. Author

N78-25538*# General Electric Co., Philadelphia, Pa. Space Div.
PROTOTYPE SOLAR HEATING AND COMBINED HEATING AND COOLING SYSTEMS Quarterly Report, Oct. - Dec. 1976
1 Jan. 1977 118 p Prepared for DoE
(Contract NAS8-32092)
(NASA-CR-150687) Avail: NTIS HC A06/MF A01 CSCL 10A
For abstract, see N78-25537.

N78-25539*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HARDWARE PROBLEMS ENCOUNTERED IN SOLAR HEATING AND COOLING SYSTEMS
Mitchell Cash May 1978 42 p Prepared for DoE
(NASA-TM-78172) Avail: NTIS HC A03/MF A01 CSCL 10A

Numerous problems in the design, production, installation, and operation of solar energy systems are discussed. Described are hardware problems, which range from simple to obscure and complex, and their resolution. Author

N78-25540*# General Electric Co., Philadelphia, Pa. Space Div.
PROTOTYPE SOLAR HEATING AND COMBINED HEATING AND COOLING SYSTEMS Quarterly Report, Jan. - Mar. 1977
1 Apr. 1977 188 p Prepared for DoE
(Contract NAS8-32092)
(NASA-CR-150691; QR-3) Avail: NTIS HC A09/MF A01 CSCL 10A

System analysis activities were directed toward refining the heating system parameters. Trade studies were performed to support hardware selections for all systems and for the heating only operational test sites in particular. The heating system qualification tests were supported by predicting qualification test component performance prior to conducting the test. Author

N78-25541*# General Electric Co., Philadelphia, Pa. Space Div.
PROTOTYPE SOLAR HEATING AND COMBINED HEATING AND COOLING SYSTEMS Quarterly Report, Apr. - Jun. 1977
1 Jul. 1977 75 p Prepared for DoE
(Contract NAS8-32092)
(NASA-CR-150692; QR-4) Avail: NTIS HC A04/MF A01 CSCL 10A

Eight prototype solar heating and combined heating and cooling systems are being developed. The effort includes development, manufacture, test, installation, maintenance, problem resolution, and performance evaluation. Author

N78-25542*# General Electric Co., Philadelphia, Pa. Space Div.
PROTOTYPE SOLAR HEATING AND COMBINED HEATING AND COOLING SYSTEMS Quarterly Report, Jul. 1977 - Sep. 1977
3 Oct. 1977 69 p Prepared for DoE
(Contract NAS8-32092)
(NASA-CR-150693; QR-5) Avail: NTIS HC A04/MF A01 CSCL 10A

Schedules and technical progress in the development of eight prototype solar heating and combined solar heating and cooling systems are reported. Particular emphasis is given to the analysis and preliminary design for the cooling subsystem, and the setup and testing of a horizontal thermal energy storage tank configuration and collector shroud evaluation. Author

N78-25543*# General Electric Co., Philadelphia, Pa. Space Div.
PROTOTYPE SOLAR HEATING AND COMBINED HEATING AND COOLING SYSTEMS Quarterly Report, Oct. - Dec. 1977
6 Jan. 1978 41 p Prepared for DoE
(Contract NAS8-32092)
(NASA-CR-150694; QR-6) Avail: NTIS HC A03/MF A01 CSCL 10A

Designs were completed, hardware was received, and hardware was shipped to two sites. A change was made in the heat pump working fluid. Problem investigation of shroud coatings for the collector received emphasis. Author

N78-25544*# Stanford Univ., Calif. Solid State Electronics Lab.
THE RECOMBINATION VELOCITY AT III-V COMPOUND HETEROJUNCTIONS WITH APPLICATIONS TO Al (x) Ga(1-x)As-GaAs(1-y)Sb(y)
Jung-Soon Kim May 1978 78 p refs
(Grant NsG-1201)
(NASA-CR-157181; SU-SEL-78-014; TR-5127-1) Avail: NTIS HC A05/MF A01 CSCL 10A

Interface recombination velocity in AlxGa1-xAs-GaAs and A10.85 Ga0.15As-GaAs1-ySby heterojunction systems was studied as a function of lattice mismatch. The results are applied to the design of highly efficient III-V heterojunction solar cells. A horizontal liquid-phase epitaxial growth system was used to prepare p-p-p and p-p-n double heterojunction test samples with specified values of x and y. Samples were grown at each composition, with different GaAs and GaAsSb layer thicknesses. A method was developed to obtain the lattice mismatch and lattice constants in mixed single crystals grown on (100) and (111)B oriented GaAs substrates. Author

N78-25545*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROGRESS ON COAL-DERIVED FUELS FOR AVIATION SYSTEMS
Robert D. Witcofski May 1978 27 p refs Presented at CTOL Transport Technol. Conf., Hampton, Va., 28 Feb. - 3 Mar. 1978. Published in NASA-CR-2036
(NASA-TM-78696; L-12275) Avail: NTIS HC A03/MF A01 CSCL 21D

Synthetic aviation kerosene (Syn. Jet-A), liquid methane (LCH4), and liquid hydrogen (LH2) appear to be the most promising coal-derived fuels. Liquid hydrogen aircraft configurations, their fuel systems, and their ground requirements at the airport are identified. These aircraft appear viable, particularly for long haul use, where aircraft fueled with coal derived LH2 would consume 9 percent less coal resources than would aircraft fueled with coal derived Syn. Jet-A. Distribution of hydrogen from the point of manufacture to airports may pose problems. Synthetic JET-A would appear to cause fewer concerns to the air transportation industry. Of the three candidate fuels, LCH4 is the most energy efficient to produce, and an aircraft fueled with coal derived LCH4 may provide both the most efficient utilization of coal resources and the least expensive ticket as well. Author

N78-25546*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DESIGN AND OPERATION OF A SOLAR HEATING AND COOLING SYSTEM FOR A RESIDENTIAL SIZE BUILDING
J. W. Littles, W. R. Humphries, and J. C. Cody May 1978 35 p Prepared for DOE
(NASA-TM-78169) Avail: NTIS HC A03/MF A01 CSCL 10A

The first year of operation of solar house is discussed. Selected design information, together with a brief system description is included. The house was equipped with an integrated solar heating and cooling system which uses fully automated state-of-the art. Evaluation of the data indicate that the solar house heating and cooling system is capable of supplying nearly 100 percent of the thermal energy required for heating and approximately 50 percent of the thermal energy required to operate the absorption cycle air conditioner. Author

N78-25547*# Wyle Labs., Inc., Huntsville, Ala. Solar Energy Systems Div.
INDOOR TEST FOR THERMAL PERFORMANCE EVALUATION ON LIFE SCIENCES ENGINEERING (AIR) SOLAR COLLECTOR
Feb. 1978 33 p Sponsored by DOE Prepared for IBM Fed. Systems Div., Huntsville, Ala.
(Contract NAS8-32036)
(NASA-CR-150665; WYLE-TR-531-18) Avail: NTIS HC A03/MF A01 CSCL 10A

The test procedure used and the results obtained from an evaluation test program conducted to obtain thermal performance data on a life sciences double-glazed air solar collector under simulated conditions is discussed. These tests were made using the Marshall Space Flight Center's solar simulator. A time constant test and incident angle modifier test were also conducted to determine the transient effect and the incident angle effect on the collector. These results and the results of the collector load test are also discussed. Author

N78-25548*# Solar Engineering and Equipment Co., Metairie, La.
DESIGN DATA BROCHURE: SOLAR HOT AIR HEATER
May 1978 30 p Prepared for DOE
(Contract NAS8-32347)
(NASA-CR-150697) Avail: NTIS HC A03/MF A01 CSCL 10A

The design, installation, performance, and application of a solar hot air heater for residential, commercial and industrial use is reported. The system has been installed at the Concho Indian School in El Reno, Oklahoma. Author

N78-25549*# Houston Chemical Co., Pittsburgh, Pa.
PRELIMINARY DESIGN PACKAGE FOR NONCORROSIVE FLUID SUBSYSTEM, SOLAR HEATING AND COOLING
May 1978 24 p Prepared for DOE
(Contract NAS8-32255)
(NASA-CR-150698) Avail: NTIS HC A02/MF A01 CSCL 10A

The preliminary evaluation includes drawings for subsystem definition, rationale for special handling, installation and maintenance tools, and an outline for hazard analysis, along with development and testing plans. Author

N78-25550*# Owens-Illinois, Inc., Toledo, Ohio.
DEVELOPMENT OF PROTOTYPE AIR/LIQUID SOLAR COLLECTOR SUBSYSTEM Quarterly Report, 1 Feb. - 30 Apr. 1978
May 1978 7 p Prepared for DOE
(Contract NAS8-32259)
(NASA-CR-150703; QR-6) Avail: NTIS HC A02/MF A01 CSCL 10A

Testing of the evacuated tubular air collector in conjunction with air/liquid heat exchange and liquid storage elements was completed. Test results emphasize matching of heat exchanger and collector characteristics with specific attention to the dynamic response of each of the elements. Author

N78-25551*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PHOTON DEGRADATION EFFECTS IN TERRESTRIAL SOLAR CELLS
V. G. Weizer, H. W. Brandhorst, Jr., J. D. Broder, R. E. Hart, and S. H. Lamneck 1978 14 p refs Presented at the 13th Photovoltaic Specialists Conf., Washington, D. C., 5-8 Jun. 1978; sponsored by IEEE
(Contract E(49-26)-1022)
(NASA-TM-78924; DOE/NASA/1022-78/35; E-9664) Avail: NTIS HC A02/MF A01 CSCL 10A

Reduction in cell output was observed in N(+)/P cells upon exposure to illumination or upon the application of a sufficiently high forward bias. Conversely, an enhancement in output was observed when P(+)/N cells were illuminated. Investigations performed on N(+)/P cells indicated that a recombination center located at E sub c - 0.37 eV in the forbidden.band was responsible for the loss in output. The center was electrically inactive in its ground state but was activated either by raising the minority carrier quasi-Fermi level sufficiently close to the latent center energy level in the band gap, or by direct excitation of electrons from the valence band to the latent center level. The center was identified as a complex of a lattice defect and a silver atom or cluster of atoms. Author

N78-25552*# IBM Federal Systems Div., Huntsville, Ala.
DESIGN DATA BROCHURE: SIMS PROTOTYPE SYSTEM 3
30 May 1978 43 p Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-150707; IBM-78W-0005) Avail: NTIS HC A03/MF A01 CSCL 10A

A closed hydronic solar system is reported for space and hot water heating. Design, performance, and hardware specifications are presented sufficient for architectural engineers and contractors to procure, install, operate, and maintain a similar solar application. Author

N78-25553*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLAR CELL SYSTEM HAVING ALTERNATING CURRENT OUTPUT Patent Application
J. C. Evans, Jr., inventor (to NASA) Filed 9 Jun. 1978 11 p
(NASA-Case-LEW-12806-1; US-Patent-Appl-SN-915050) Avail: NTIS HC A02/MF A01 CSCL 10A

A P-N junction solar cell modified by fabricating an integrated circuit inverter on the back of the cell to produce a device capable of generating an alternating current output was developed. In another embodiment, integrated circuit power conditioning electronics is incorporated in a module containing a solar cell power supply. NASA

N78-25554*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTROCHEMICAL CELL FOR REBALANCING REDOX FLOW SYSTEM Patent Application
Lawrence H. Thaller, inventor (to NASA) Filed 9 Jun. 1978 12 p
(NASA-Case-LEW-13150-1; US-Patent-Appl-SN-914260) Avail: NTIS HC A02/MF A01 CSCL 10A

Electricity producing cells which utilize reduction and oxidation of anode and cathode fluids are called REDOX cells. The fluids were aqueous solutions of HCl each including a different metal chloride salt and were separated by a membrane which was permeable to certain ions. A provision of a rebalancing cell is provided, which utilized gas from undesirable side reactions and/or from an independent source to rebalance the anode and cathode fluids in a REDOX system. NASA

N78-25555*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CESIUM THERMIONIC CONVERTERS HAVING IMPROVED ELECTRODES Patent Application
James F. Morris, inventor (to NASA) Filed 1 May 1978 9 p
(NASA-Case-LEW-12038-3; US-Patent-Appl-SN-901892) Avail: NTIS HC A02/MF A01 CSCL 10A

A high electric-power output thermionic converter is reported that uses a combination of lanthanum hexaboride emitter and collector electrodes in a cesium medium. The interaction between the lanthanum hexaboride electrodes and cesium vapor, which is adsorbed on the lanthanum hexaboride electrodes, results in lower emitter and collector work functions to produce a thermionic converter with high current density and voltage output. The lanthanum hexaboride emitter and collector electrodes employed in the cesium thermionic converter can be either in the monocrystalline or polycrystalline state. NASA

N78-25556*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPROVED BACK WALL CELL Patent Application
Henry W. Brandhorst, Jr., inventor (to NASA) Filed 24 Apr. 1978 13 p
(NASA-Case-LEW-12236-2; US-Patent-Appl-SN-899123) Avail: NTIS HC A02/MF A01 CSCL 10A

Back-wall solar wells are described that consist of a first material of one conductivity type with one face more heavily doped to form a field region to receive radiant energy. A layer of opposite conductivity, or a metallic layer forming a Schottky barrier, was applied to the opposite face. A gridded contact previous to the radiant energy was applied to the region of the heavily doped material for electrical contact. Separate control of either the p-n junction or the Schottky diode junction provided for efficient collection of light. NASA

N78-25557*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STAINLESS STEEL PANEL FOR SELECTIVE ABSORPTION OF SOLAR ENERGY AND THE METHOD OF PRODUCING SAID PANEL Patent Application
Marion L. Roberts, Max H. Sharpe, and Albert C. Krupnick, inventors (to NASA) Filed 30 May 1978 23 p
(NASA-Case-MFS-23518-3; US-Patent-Appl-SN-910793) Avail: NTIS HC A02/MF A01 CSCL 10A

A composite panel is reported that contains a coated metal substrate which absorbs solar energy selectively. The panel consisted either of an aluminum substrate with zinc and nickel layers and an outer coating of nickel oxide, or a copper substrate with nickel and nickel oxide layers. NASA

N78-25558*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD FOR FABRICATING SOLAR CELLS HAVING INTEGRAL COLLECTOR GRIDS Patent Application
John C. Evans, Jr., inventor (to NASA) Filed 23 Dec. 1977 17 p
(NASA-Case-LEW-12819-2; US-Patent-Appl-SN-863770) Avail: NTIS HC A02/MF A01 CSCL 10A

A photovoltaic device was designed which possesses an integral mixed metal oxide coating in which is embedded a metallic network which functions as an efficient collector for electrons set in motion by the photovoltaic process. The metal grid system is formed from the metal elements of the transparent, conductive mixed metal oxide coating which is in contact with the oxide coating which constitutes the barrier of the devices with the semiconductor substrate. NASA

N78-25559*# National Aeronautics and Space Administration. Pasadena Office, Calif.
LOW COST SOLAR ENERGY COLLECTION SYSTEM Patent Application
Charles G. Miller (JPL) and James B. Stephens, inventors (to NASA) (JPL) Filed 15 May 1978 23 p
(Contract NAS7-100)
(NASA-Case-NPO-13579-4; US-Patent-Appl-SN-906297) Avail: NTIS HC A02/MF A01 CSCL 10A

A fixed, linear, ground based primary reflector was designed for use in a tracking solar energy collection system. The primary reflector was constructed at ground level by slip forming in concrete or stabilized dirt a trough with a segmented one dimensional circular cross section profile. This profile was covered with an inexpensive light-reflective material. The axis of the primary reflector was optimally aligned with respect to the sun path in the area. NASA

N78-25560*# National Aeronautics and Space Administration. Pasadena Office, Calif.
A SOLAR ARRAY STRIP AND A METHOD FOR FORMING THE SAME Patent Application
Robert L. Mueller (JPL) and Robert K. Yasui, inventors (to NASA) (JPL) Filed 29 Mar. 1978 15 p
(Contract NAS7-100)
(NASA-Case-NPO-13652-3; US-Patent-Appl-SN-891358) Avail: NTIS HC A02/MF A01 CSCL 10A

A method is provided for forming a flexible solar array strip adapted for storage in a helically wound roll. The method is applicable to automated production techniques where a continuous solar arrays strip may be used economically in converting solar flux to electrical energy. NASA

N78-25561# Ohman Research Lab., Sandwich, Mass.
INVESTIGATION OF THE ENVIRONMENTAL CONSEQUENCES OF DISPOSAL OF THE LITHIUM-ORGANIC ELECTROLYTE/SO2 BATTERY Final Report, Sep. 1976 - Jan. 1978
K. Crumrine, E. Juergens, Mike Slimak, J. Freed, and C. Colburn Mar. 1978 124 p refs
(Contract DAAB07-76-C-1752; DA Proj. 495F)
(AD-A053194; ECOM-76-1752-F) Avail: NTIS HC A06/MF A01 CSCL 10/3

This report contains recommendations for disposal of lithium organic-electrolyte/SO2 batteries (standard composition and modified composition) based upon a review of toxicity of battery constituents and laboratory analysis of leachate and solubility tests from cross-sectioned batteries. Laboratory analysis identified an average of 22 mg of cyanide ion per cell in the discharged standard composition cell and 1.6 mg in an undischarged cell. Soil leachate column tests showed significant quantities of cyanide in the leachate from discharged standard composition cells. Disposal recommendations for the standard cell include secured landfills or disposal ponds. Laboratory analysis of solubility tests showed an average of 0.16 mg of cyanide per cell in the discharged modified composition cell. Disposal recommendations for the modified cell are sanitary landfills or the equivalent.
Author (GRA)

N78-25562# UOP, Inc. Des Plaines, Ill.
OPTIMIZATION OF PtDOPED KOCITE: ELECTRODES IN H3PO4 FUEL CELLS Interim Progress Report, 30 Mar. - 30 Dec. 1977
L. B. Welsh and R. W. Leyerle Jan. 1978 47 p refs
(Contract DAAG53-76-C-0014; DA Proj. 1G7-62708-AH-67)
(AD-A053300; IPR-4) Avail: NTIS HC A03/MF A02 CSCL 10/2

The use of Kocite(Trade Name) electrocatalysts as low-cost air and/or fuel electrocatalysts in phosphoric acid electrolyte fuel cells is being optimized with respect to some of the electrocatalyst and electrode structure parameters. Kocite electrocatalysts are made from Kocite materials, which are composite structures consisting of pyropolymers chemically bonded to refractory substrates. Fuel cell electrodes are fabricated from these electrocatalysts and normally tested as anodes or cathodes in model fuel cells with standard platinum-black counter electrodes. GRA

N78-25563# Oak Ridge National Lab., Tenn.
CENTRAL COOLING: ABSORPTIVE CHILLERS
J. E. Christian Aug. 1977 75 p refs Prepared for ANL
(Contract W-31-109-eng-38)
(ANL/CES/TE-77-8) Avail: NTIS HC A04/MF A01

Data are provided to estimate absorption-chiller performance at off nominal operating conditions. The part-load performance curves along with cost estimating functions help the system design engineer select absorption equipment for a particular application based on life cycle costs. ERA

N78-25564# Oak Ridge National Lab., Tenn.
CENTRAL HEATING: PACKAGE BOILERS
Ebrahim Farahan May 1977 87 p refs Prepared for Argonne Natl. Lab., Ill.
(Contract W-31-109-eng-38)
(ANL/CES/TE-77-6) Avail: NTIS HC A05/MF A01

Performance and cost data for electrical and fossil-fired package boilers currently available from manufacturers are provided. Performance characteristics investigated include: unit efficiency, rated capacity, and average expected lifetime of units. Costs are tabulated for equipment and installation of various package boilers. The information supplied in this report will simplify the process of selecting package boilers required for industrial, commercial, and residential applications. ERA

N78-25565# Boeing Co., Seattle, Wash.
CENTRAL RECEIVER SOLAR THERMAL POWER SYSTEM PILOT PLANT PRELIMINARY DESIGN REPORT. VOLUME 3: COLLECTOR SUBSYSTEM
29 Apr. 1977 202 p refs
(Contract EY-76-C-03-1111)
(SAN/1111-8/2) Avail: NTIS HC A10/MF A01

A preliminary design of the collector (heliostat) subsystem for a 10 MW/sub e/ Solar Pilot Plant is presented. The collector subsystem concept, operating with a central receiver installation, is shown. In this concept, circular membrane reflectors formed with aluminized polyester film, direct sunlight to the central receiver. Transparent air-support Tedlar enclosures protect the lightweight reflectors from the environment. Reflectors are individually aimed with a 2 axis gimbal, driven by digital-controlled stepper motors. Minicomputers, located at the central control facility, provide signals to the stepper motors. Field geometry, performance, and cost analyses have resulted in specification of 1650 heliostats, to provide 42 MW/sub th/ to a cylindrical receiver at solar noon on the equinox. Overall efficiency of the heliostat field is 54.5 percent at the design point. Components, materials, and large scale hardware were developed and tested. ERA

N78-25566# Aerodyne Research, Inc., Bedford, Mass.
CHARACTERIZATION OF OPEN-CYCLE COAL-FIRED MHD GENERATORS, REVISION A Quarterly Technical Summary Report No. 4, 1 Apr. - 30 Jun. 1977
C. E. Kolb, V. Yousefian, J. Wormhoudt, M. Martinez-Sanchez, and J. L. Kerrebrock 15 Jul. 1977 90 p refs
(Contract EX-76-C-01-2478)
(FE-2478-4-Rev-A) Avail: NTIS HC A05/MF A01

Research progress on the effects of slags on the electron and alkali seed chemistry in a high temperature coal combustion system such as direct-fired MHD generators is reported. Problems

studied include the formation of negative ions due to electron attachment processes in combustion flow, the role slag condensation may play in determining the electron density through recombination which adversely affects conductivity in the core flow, and the interaction of alkali seed with particles formed by slag condensation in the generator channel. Models will describe the appropriate fluid mechanical conditions expected in direct fired MHD channels and will permit the calculation, through the appropriate chemical equilibrium or chemical kinetic equations, of the changes in negative ion, alkali and slag conditions as the fluid conditions change. A one-dimensional model of the fluid and MHD processes in the channel core flow has been completed. ERA

N78-25567# Argonne National Lab., Ill.
GASCON AND MHDGAS: FORTRAN IV COMPUTER CODES FOR CALCULATING GAS AND CONDENSED-PHASE COMPOSITIONS IN THE COAL-FIRED OPEN-CYCLE MHD SYSTEM
P. E. Blackburn Dec. 1977 64 p refs
(Contract W-31-109-eng-38)
(ANL/MHD-77-4) Avail: NTIS HC A04/MF A01

FORTRAN 4 computer codes were written to calculate the equilibrium partial pressures of the gaseous phase and the quantity and composition of the condensed phases in the open cycle MHD system. The codes are based on temperature-dependent equilibrium constants, mass conservation, the mass action law, and assumed ideal solution of compounds in each of two condensed phases. It is assumed that the phases are an oxide-silicate phase and a sulfate-carbonate-hydroxide phase. Two versions of the computer code were written. GASCON calculates the equilibrium gas partial pressures and the quantity and composition of the condensed phases in steps of thirteen temperature and pressure combinations in which the condensate is removed after each step, simulating continuous slag removal from the MHD system. MHDGAS retains the condensate for each step, simulating flow of condensate through the MHD system. ERA

N78-25568# Argonne National Lab., Ill.
ANALYSIS OF A HIGH-TEMPERATURE COAL COMBUSTOR ACCORDING TO A ONE-DIMENSIONAL FLOW MODEL
P. M. Chung and R. S. Smith Oct. 1977 133 p refs
(Contract W-31-109-eng-38)
(ANL/MHD-77-2) Avail: NTIS HC A07/MF A01

A steady state, one-dimensional analysis for a high temperature coal combustor is presented. An existing solution of solid fuel ignition is employed to describe the ignition of the coal particles. A one-dimensional flow model with radiative heat loss is then constructed to describe the subsequent vaporization of ash and devolationization, combustion, and gasification of the coal. Combustion is considered to take place either at a flame sheet in the diffusion layer surrounding each particle or at the particle surface. The combustion products are considered to be redistributed in the main gas stream of the combustor according to simplified chemical equilibrium criteria. A simplified devolatization rate law is formulated, which incorporates in a tractable manner the various competing reactions within the coal particle. Data are presented for the variation of temperatures and mass fractions with position in the combustor and for the influence of various parameters on combustor performance. ERA

N78-25569# Acurex Corp., Mountain View, Calif. Aerotherm Div.
APPLICATION OF SOLAR ENERGY TO THE SUPPLY OF INDUSTRIAL PROCESS HOT WATER: PRELIMINARY DESIGN AND PERFORMANCE REPORT. VOLUME 1: TECHNICAL REPORT
14 Oct. 1976 167 p refs
(Contracts EY-76-C-03-1218; E(04-3)-1218)
(SAN/1218-3-Vol-1; TR-76-219-Vol-1) Avail: NTIS HC A08/MF A01

The design and performance of a solar hot water system for can washing are presented. The collector field is located on the roof of the finished products warehouse. Detail drawings and descriptions of the collector field, installation, piping, controls, data acquisition equipment, and roof structure are included. Futhermore, a program schedule with equipment and manpower costs for successfully completing Phase 2 of this contract is included. Also included is an organization chart of the Phase 2 program personnel. ERA

N78-25570# RAND Corp., Santa Monica, Calif.
NOBLE-GAS CLOSED-CYCLE SYSTEM OF MAGNETOHYDRODYNAMIC POWER GENERATION
R. Y. Pri and R. W. Hess Aug. 1977 94 p refs
(Contract EX-76-C-01-2261)
(R-2128-ERDA) Avail: NTIS HC A05/MF A01

The critical components of the closed cycle system, like those of the open cycle system, are the coal combustor, heat exchanger, MHD generator, seed recovery system, and power conditioning equipment. Although the components may be common, the technologies pacing the development of the two systems differ substantially. The current concept for the design of a closed cycle system calls for a regenerative heat exchanger in which the same refractory surface will come in contact with both the combustion gases and the working fluid. The heat exchanger must be designed to ensure a low enough level of contamination carry over and leakage to maintain the noble gas loop. The same type of heat exchanger used as the air preheater in an open cycle system presumably could tolerate greater leakage and contamination. ERA

N78-25571# Energy Research and Development Administration, Washington, D. C.
REPORT ON ERDA WORKSHOP WITH SOUTHEASTERN STATES AND CITIES ON IMPROVING COORDINATION IN ENERGY RD AND D ESPECIALLY FOR SOLAR PROGRAMS
1977 30 p Workshop held in Knoxville, Tenn., 7-8 Jul. 1977
(TID-27778) Avail: NTIS HC A03/MF A01

Issues and problems were identified and recommendations were made regarding ways to facilitate ERDA/State/City coordination and communication especially with regard to ERDA's solar energy RD and D program. Major recommendations resulting from the workshop are summarized. ERA

N78-25572# Seattle Dept. of Lighting, Wash.
OFFICE OF CONSERVATION Quarterly Report, Jul. - Sep. 1977
1977 161 p refs
(Contract EC-77-G-01-5097)
(TID-27998; QR-3) Avail: NTIS HC A08/MF A01

Progress in Seattle City Light's energy conservation program is reported. This program promoted electric power conservation in the industrial, commercial, and residential sector by performing energy audits on buildings, conducting energy conservation seminars, recommending educational and legislative programs for energy conservation, facilitating the purchase and certification of home insulation, providing educational displays, and sponsoring conservation research. It is claimed that electric power consumption for this area was reduced from projected consumption figures by 80 MW. ERA

N78-25573# Mechanical Technology, Inc., Latham, N. Y.
DESIGN, DEVELOP, AND MANUFACTURE PROCESS GAS LUBRICATED HOT RECYCLE GAS CIRCULATORS Final Technical Report
D. G. Dominy and J. D. Hurley Oct. 1976 150 p
(Contract EY-76-C-02-0004)
(COO-0004-1; MTI-77TR5) Avail: NTIS HC A07/MF A01

In the SYNTHANE coal gasification process raw product gas of approximately 35 mole % methane is passed through a methanator which increases the methane content (and heating value) to approximately 86 mole % methane. In order to limit the temperature rise of the reaction, high BTU methane process gas is diluted with raw product gas. A pressure increase is necessary to force the mixed gases back into the methanator. In addition, varying recycle ratios affect the total flow of the gas stream necessitating a compressor or other device to operate at varying flow capacities. The present hot gas recycle methanator system utilized an eductor to mix and raise the pressure of the product gas. This method has limitations. For commercial use a compressor is essential. ERA

N78-25574# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
TEST AND EVALUATION OF THE PERFORMANCE OF SOLAR RADIATION SENSORS AT INCLINATION FROM THE HORIZONTAL UNDER LABORATORY AND FIELD CONDITIONS Final Report
E. C. Flowers Sep. 1977 20 p
(Contract EX-76-A-29-1041)
(DSE/1041-1) Avail: NTIS HC A02/MF A01

Ten different pyranometer models were tested to determine changes in sensitivity due to exposure at a tilt. The silicon cell pyranometers manufactured by Matrix and Lambda showed no effect due to tilt; the Eppley PSP; Spectrolab SR 73 and SR 75, Kipp solarimeter, and Kahl star showed changes of 1 percent or less for tilt angles of 10 to 90 degrees from horizontal; the Eppley 848 star, Kahl mini, Hy-Cal hytherm, and Lintronic showed changes greater than 1 percent and as high as 8 percent for the Lintronic over the same tilt angles. Correction factors are given for the 10 models. ERA

N78-25575# Argonne National Lab., Ill.
LABORATORY SUPPORT FOR IN SITU GASIFICATION REACTION KINETICS Quarterly Report, Jan. - Mar. 1977
J. Fischer, J. E. Young, J. E. Johnson, D. C. Bowyer, and A. A. Jonke Jun. 1977 20 p refs
(Contract W-31-109-eng-38)
(ANL/CEN/FE-77-2) Avail: NTIS HC A02/MF A01

Support studies for the national endeavor on in-situ coal gasification are reported. The objective is to determine the reaction-controlling variables and reaction kinetics for gasification of chars resulting when coal is pyrolyzed in underground gasification. The reactions to be studied include steam-char, CO2-char, H2-char, and the water-gas shift reaction. Kinetic data related to the reaction of steam with Wyodak subbituminous coal are presented. The temperature dependence of the reaction, the apparent reaction order with respect to steam, and inhibitory effects of hydrogen are discussed. ERA

N78-25576# Oak Ridge National Lab., Tenn.
COAL-FIRED ALKALI METAL POWER SYSTEM DESIGN STUDY Quarterly Progress Report, 1 Apr. - 30 Jun. 1977
Garland Samuels Aug. 1977 32 p refs
(Contract W-7405-eng-26)
(ORNL-TM-6000; QPR-3) Avail: NTIS HC A03/MF A01

The report given is the third of a series of quarterly progress reports for the Coal-Fired Alkali Metal Power System Design Study. The effort during this quarter was devoted to the design and analysis of an atmospheric pressure fluidized bed furnace-boiler system for either cesium or potassium. The tasks receiving the most attention during this period were the selection and analysis of the basic plant arrangement, the design of the furnace-alkali metal boiler, and the analysis of the alkali metal condenser-steam boiler. ERA

N78-25577# Monosolar, Inc., Santa Monica, Calif.
IMPROVED SEMICONDUCTORS FOR PHOTOVOLTAIC SOLAR CELLS Quarterly Report, 1 Oct. - 31 Dec. 1976
25 Jan. 1977 8 p
(Contract EX-76-C-01-2457)
(DSE/2457-2; QR-2) Avail: NTIS HC A02/MF A01

Electrochemical deposition of homogeneous pinhole-free films of cadmium telluride and cadmium telluride alloys on light-transparent tin dioxide coatings over Pyrex glass substrates is reported. Impurities have been reduced to a level wherein it is possible now to grow CdTe layers electrochemically of either p-or n-type conductivity by changing the deposition potentials. N-type material was produced by simultaneously electrochemically depositing indium dopant along with the cadmium telluride. ERA

N78-25578# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Chemistry.
IMPROVED CATHODES FOR PHOSPHORIC ACID FUEL CELLS Final Report
Ernest B. Yeager, P. Bindra, N. Doddapaneni, J. C Huang, R. K. Sen, and J. Zagal Jun. 1977 91 p refs
(EPRI Proj. 634-1)
(EPRI-EM-505) Avail: NTIS HC A05/MF A01

Oxygen reduction was examined on a number of electrode surfaces with both rotating disk and gas fed electrodes. Particular emphasis was placed on transition metal monomeric and polymeric phthalocyanines. The iron and cobalt complexes have substantial activity for O2 reduction but are still well short of that for Pt and have long-term stability problems in 85% H3PO4. The objectives of the project were broadened to include the identification and optimization of the factors which control O2 reduction on platinum in phosphoric acid. Kinetic studies on Pt in purified 85% H3PO4 indicate O2 reduction via two parallel mechanisms with the non-peroxide pathway predominant over the peroxide pathway. ERA

N78-25579# Chevron Research Co., Richmond, Calif.
CATALYTIC HYDROPROCESSING OF SHALE OIL TO PRODUCE DISTILLATE FUELS
R. F. Sullivan and B. E. Stangeland 1977 42 p refs Presented at the 174th Natl. Am. Chem. Soc. Symp., Chicago, 28 Aug. - 2 Sep. 1977
(Contract EX-76-C-01-2315)
(CONF-770814-9) Avail: NTIS HC A03/MF A01

Results are presented of a study to demonstrate the feasibility of converting whole shale oil to a synthetic crude resembling a typical petroleum distillate. The synthetic crude thus produced can then be processed, in conventional petroleum-refining facilities, to transportation fuels such as high octane gasoline, diesel, and jet fuel. It is shown that whole shale oil can be catalytically hydrodenitrified with the resulting synthetic crude resembling a petroleum distillate that can be fractionated and further processed. Shale oil contains about 0.6% sulfur. Sulfur is more easily removed by hydrofining than is nitrogen. Oxygen contained in the shale oil is also reduced to low levels during hydrodenitrification. The shale oil contains appreciable quantities of iron and arsenic which are removed by a guard bed placed upstream from the hydrofining catalyst. The naphthas from the shale oil hydrofiner can readily be upgraded to high octane gasoline by catalytic reforming. The middle distillate fraction may require some additional hydrofining to produce salable diesel or jet fuel. ERA

N78-25580# General Electric Co., Sunnyvale, Calif. Fast Breeder Reactor Dept.
EVALUATION OF HYDRAULIC TEST MODEL (HTM) FLOW DISTRIBUTION TEST RESULTS
Y. J. Lee May 1977 37 p refs Sponsored by DOE
(GEFR-00114(L)) Avail: NTIS HC A03/MF A01

The CRBR steam generator Hydraulic Test Model (HTM) flow distribution test results were evaluated, and it is found that the performance degradation due to the flow nonuniformity observed in the HTM test is negligible; 0.06% for the evaporator and nil for the superheater. Also, the fact that ambient temperature water was used in the test instead of hot sodium with temperature gradients does not introduce significant errors in applying the HTM test results for the tested flow rate range to the CRBR steam generator flow pattern. ERA

N78-25581# International Institute for Applied Systems Analysis, Laxenburg (Austria).
SYSTEMS ASPECTS OF LARGE-SCALE SOLAR ENERGY CONVERSION
J. M. Weingart May 1977 36 p refs Presented at the Intern. Symp. on New Trends in Systems Anal., Versailles, France, 13-17 Dec. 1976
(IIASA-RM-77-23; Conf-761246-1) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

The initial stage of solar energy development would include local low temperature applications for heating purposes, and the embedding of small amounts of solar electric generation capacity in the existing electric grids. Regional interconnections of solar electric power generation would be followed by increasing production of solar fuels in locations with favorable insolation, and by long-distance transport of these fuels. Much more needs to be known about the behavior of very large integrated solar energy conversion systems. Market penetration calculations indicate that it takes roughly five decades for a major source of energy to be developed and used on a truly significant scale. It therefore would be necessary to initiate large-scale deployment of solar energy perhaps 50 years or more before fossil resources are finally depleted. ERA

N78-25582# Energy Research and Development Administration, Washington, D. C. Office of the Assistant Administrator to Fossil Energy.
FOSSIL ENERGY PROGRAM REPORT Progress Report, Jul. 1975 - Oct. 1976
Sep. 1977 650 p
(ERDA-77-70) Avail: NTIS HC A99/MF A01

A review is given with respect to objectives, importance, and accomplishments US ERDA's research programs in coal liquefaction, coal gasification (high- and low-Btu gas), advanced power systems, combustion, materials research, process research, component research, magnetohydrodynamics (open- and closed-cycle systems), enhanced recovery of petroleum and natural gas, in-situ oil shale technology, commercial applications, and various program planning and analysis projects. ERA

N78-25583# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.
SOLAR PILOT PLANT, PHASE 1, PRELIMINARY DESIGN REPORT. VOLUME 2, BOOK 2: CENTRAL RECEIVER OPTICAL MODEL USERS MANUAL, CDRL ITEM 2
1 May 1977 228 p
(Contract EY-76-C-03-1109)
(SAN/1109-8/3-Vol-2-Bk-2) Avail: NTIS HC A11/MF A01

A FORTRAN computer program (HELIAKI) which simulates the optical/thermal performance of a central receiver solar heat to electricity is described. The power retained by the cavity receiver at any point in time or the energy into the receiver over a year's time is calculated using a Monte Carlo ray trace technique to solve the multiple integral equations. An artist's concept of this plant is shown. ERA

N78-25584# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.
SOLAR PILOT PLANT, PHASE 1, PRELIMINARY DESIGN REPORT. VOLUME 2, BOOK 3: DYNAMIC SIMULATION MODEL AND COMPUTER PROGRAM DESCRIPTIONS, CDRL ITEM 2
1 May 1977 358 p refs
(Contract EY-76-C-03-1109)
(SAN/1109-8/4-Vol-2-Bk-3) Avail: NTIS HC A16/MF A01

The mathematical models and computer program comprising the solar power plant (SPP) dynamic simulation are described. The SPP dynamic simulation is a computerized model representing the time-varying performance characteristics of the SPP. A master control/instrumentation system is utilized to coordinate the various plant operations. The master controller reacts to plant operator demands and control settings to effect the desired output response. The SPP dynamic simulation computer program is written in FORTRAN language. Various input options (e.g., insolation values, load demands, initial pressures/temperatures/flows) are permitted. Plant performance may be monitored via computer printout or computer generated plots. The detailed pilot plant dynamic model, the basis for this simulation, and the utilization of this simulation to obtain analytical plant performance results are described. ERA

N78-25585# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.
SOLAR PILOT PLANT, PHASE 1, PRELIMINARY DESIGN REPORT. VOLUME 3: COLLECTOR SUBSYSTEM, CDRL ITEM 2
1 May 1977 571 p
(Contract EY-76-C-03-1109)
(SAN/1109-8/5-Vol-3) Avail: NTIS HC A24/MF A01

A low profile, multifaceted heliostat designed to provide high reflectivity and accurate angular and spatial positioning of the redirected solar energy under all conditions of wind load and mirror attitude within the design operational envelope is described. The heliostats are arranged in a circular field around a cavity receiver on a tower halfway south of the field center. A calibration array mounted on the receiver tower provides capability to measure individual heliostat beam location and energy periodically. This information and weather data from the collector field are transmitted to a computerized control subsystem that addresses the individual heliostat to correct pointing errors and determine when the mirrors need cleaning. Results of the SRE heliostat test program are presented. ERA

N78-25586# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.
SOLAR PILOT PLANT, PHASE 1, PRELIMINARY DESIGN REPORT. VOLUME 6: ELECTRICAL POWER GENERATION; MASTER CONTROL SUBSYSTEMS; BALANCE OF PLANT CDRL ITEM 2
1 May 1977 373 p
(Contract EY-76-C-03-1109)
(SAN/1109-8/8-Vol-6) Avail: NTIS HC A16/MF A01

The relationship of the electrical power generation subsystem to the rest of the plant, the design methodology and evolution, the interface integration and control, and the operation and maintenance procedures were described. ERA

N78-25587# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
INDUSTRIAL APPLICATIONS OF SOLAR TOTAL ENERGY. VOLUME 1: SUMMARY Final Report
Apr. 1977 37 p
(Contract EY-76-C-03-1132)
(SAN/1132-2/1-Vol-1) Avail: NTIS HC A03/MF A01

A summary of the program to define solar energy systems that are technically and economically feasible that can satisfy all or part of selected industry demands and to determine the market potential of such systems is given. The primary emphasis was placed on the application of total energy systems where the industrial process heat, electrical demands, and space heating and cooling are satisfied at maximum possible efficiency. Industrial energy usage was first determined, leading to a survey of those which were energy-intensive. Concurrently with the industry survey, subsystem methodologies were established in the areas of insolation data retrieval, collector performance and sizing, thermal storage, energy conversion, and heat transport. In excess of 40, first-level designs were generated allowing a preliminary ranking and selection of industries for the conceptual design phase. Volumes 2, 3, 4 and 5 of this report contain detailed results. ERA

N78-25588# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
INDUSTRIAL APPLICATIONS OF SOLAR TOTAL ENERGY. VOLUME 2: TECHNICAL Final Report
Apr. 1977 240 p refs
(Contract EY-76-C-03-1132)
(SAN/1132-2/2-Vol-2) Avail: NTIS HC A11/MF A01

For abstract, see N78-25587.

N78-25589# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
INDUSTRIAL APPLICATIONS OF SOLAR TOTAL ENERGY. VOLUME 3: MARKET PENETRATION Final Report
Apr. 1977 179 p
(Contract EY-76-C-03-1132)
(SAN/1132-2/3-Vol-3) Avail: NTIS HC A09/MF A01

An integrated economic/market penetration model was developed to simulate the impact of the various quantifiable parameters on the economic viability and market penetration potential of specific solar total energy systems. The two basic types of solar total-energy-system configurations considered in this analysis are: (1) central receiver systems and (2) distributed concentrating systems. Conceptual-system designs have been developed for each of the systems and in each of the five candidate-industry applications. The conceptual designs developed for each industry were used as reference baselines to determine economic viability of specific applications. The five industries that were selected are: (1) meat packing industry; (2) fluid milk industry; (3) sugar beet industry; (4) asphalt material industry; and (5) concrete block. ERA

N78-25590# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
INDUSTRIAL APPLICATIONS OF SOLAR TOTAL ENERGY. VOLUME 5: CATALOG OF CONCEPTUAL DESIGNS Final Report
Apr. 1977 100 p
(Contract EY-76-C-03-1132)
(SAN/1132-2/5-Vol-5) Avail: NTIS HC A05/MF A01

Conceptual designs for five industries have been completed

(meat packing, fluid milk, sugar beets, asphalt materials, and concrete block). Each industry was evaluated at a primary location corresponding to the location of an actual industry whose demand was used in sizing the Solar Total Energy Station (STES). Three alternate locations were selected for each industry. In all, 12 locations were analyzed. Six of the locations were assessed for more than one industry. Two different types of collector fields were sized and their performance analyzed for each industry/location. The collector types were central receiver and two-axis tracking distributed collectors. One industry, meat packing, was also analyzed using one-axis tracking distributed collectors as well. All of the designs are hybrid in nature, that is, they use auxiliary energy supplied by fossil-fueled heaters during times of reduced insolation. Component summaries including major subsystem descriptions and operating parameters are included. ERA

N78-25591# California Univ., Livermore. Lawrence Livermore Lab.
LLL TOTAL FLOW GEOTHERMAL PROGRAM: SUMMARY OF TWO-PHASE NOZZLE TESTS FOR SCALE CONTROL AND MATERIALS PERFORMANCE
G. E. Tardiff, ed. 1 Dec. 1977 17 p refs
(Contract W-7405-eng-48)
(UCID-17636) Avail: NTIS HC A02/MF A01

A series of nozzle and wearblade tests to evaluate scale control and materials performance under total flow nozzle inlet conditions and simulated turbine blade environments was completed. Brine acidification was effective in preventing scale in nozzles and on wearblade flow surfaces. Acid consumption measurements indicate that acid cost will be less than 2 mills/100 lb. brine. Measured erosion rates were low and the results indicate that available materials will allow successful turbine operation for many years. Stress corrosion cracking was not observed in specimens of the leading candidate turbine material (Ti-6A1-4V) after up to 60 hours operation at stresses similar to those expected in an operating turbine system. ERA

N78-25592# California Univ., Livermore. Lawrence Livermore Lab.
FIBER COMPOSITE FLYWHEEL PROGRAM Quarterly Progress Report, Jul. - Sep. 1977
J. A. Rinde 2 Dec. 1977 8 p
(Contract W-7405-eng-48)
(UCRL-50033-77-3) Avail: NTIS HC A02/MF A01

Fiber composite flywheels are planned for use in energy storage systems because they have strength-to-density ratios, enabling them to store large amounts of kinetic energy per unit mass. Research progress is reported in the areas of stress rupture, composite properties, and composites with flexible matrices. ERA

N78-25593# Argonne National Lab., Ill.
HIGH-PERFORMANCE BATTERIES FOR STATIONARY ENERGY STORAGE AND ELECTRIC-VEHICLE PROPULSION Progress Report, Apr. - Jun. 1977
Oct. 1977 77 p refs
(Contract W-31-109-eng-38)
(ANL-77-68) Avail: NTIS HC A05/MF A01

Research, development, and management activities of the program on lithium aluminum/metal sulfide batteries are described. The cells are of a vertically oriented, prismatic design with a central positive electrode of FeS or FeS2, two facing negative electrodes of lithium - aluminum alloy, and a electrolyte of molten LiCl - KCl. The concepts receiving major attention are carbon-bonded positive electrodes, scaled-up designs of stationary energy storage cells, additives to extend electrode lifetime, alternative electrode separators, and pellet-grid electrodes. Materials development efforts included the development of a lightweight electrical feedthrough; studies of various current-collector designs; investigation of powder separators; wettability and corrosion tests of materials for cell components; and postoperative examinations of cells. Voltametric studies were conducted to investigate the reversibility of the FeS2 electrode. The use of calcium and magnesium alloys for the negative electrode in advanced battery systems were investigated. ERA

N78-25594# Department of Energy, Washington, D. C. Div. of Manpower Assessment.
ENERGY-RELATED DOCTORAL SCIENTISTS AND ENGINEERS IN THE UNITED STATES, 1975
Nov. 1977 84 p
(DOE/IR-0033) Avail: NTIS HC A05/MF A01

The pursuit of a vigorous research and development program to provide renewable and other resources to meet U.S. energy needs in the next century is an important objective of President Carter's National Energy Plan. A highly educated and motivated pool of engineers and scientists must be available for energy research and development if this objective is to be achieved. This report provides, for the first time, information about the number and characteristics of doctoral-level engineers and scientists in primarily energy-related activities. These data for the year 1975 will become part of the data base for a program of continuing studies on the employment and utilization of all scientists and engineers involved in energy-related activities. Information is provided for employment in the following fields: mathematics; physics/astronomy; chemistry; earth, environment, and marine sciences; engineering; life sciences; psychology; social sciences; arts and humanities; and education and business. ERA

N78-25595# Brookhaven National Lab., Upton, N. Y. Energy Technology Assessment Group.
ENERGY MODELING AND DATA SUPPORT FOR THE ELECTRIC POWER RESEARCH INSTITUTE Annual Report
H. Abilock, M. Beller, E. A. Cheriavsky, A. Hermelee, L. L. Juang, and W. Marchuse Jul. 1977 75 p refs
(Contract EY-76-C-02-0016; EPRI Proj. RP442-1)
(BNL-50696) Avail: NTIS HC A04/MF A01

Reference energy systems were formulated for the base year 1972 and projections developed for the years 1980, 1985, and 2000 for the area serviced by the New York power pool. In addition, Brookhaven, EPRI, and the Tennessee Valley Authority entered into a cooperative effort to develop demand projections for the area serviced by TVA. The RES and associated data provided a baseline against which TVA evaluated the effect of substituting alternate technologies and policies for one another. Development of the dynamic energy systems optimization model is continuing, with effort this year directed toward better representation of the electrical sector within the model. The model was reformulated such that the year was divided into three seasons and two daily divisions, thus allowing the model to choose whether a summer or winter peak occur and to better depict the yearly time dependence of demands. ERA

N78-25596# Economics Research Group Ltd., Toronto (Ontario).
DYNAMIC MODELS OF THE INDUSTRIAL DEMAND FOR ENERGY Interim Report
Ernst R. Berndt, Melvyn A. Fuss, and Leonard Waverman Nov. 1977 147 p refs Prepared for EPRI, Palo Alto, Calif.
(EPRI Proj. 683-1)
(EPRI-EA-580) Avail: NTIS HC A07/MF A01

Econometric approaches to modeling the demand for electricity, petroleum, coal, and natural gas by the manufacturing sector of the U.S. economy are investigated. Aspects of the research are incorporation of dynamic effects as well as an introduction of the impact of technological change on energy usage. An analysis of the effects of an investment tax credit on both the long-run demand for energy and the adjustment path to the new long-run equilibrium demand was made. Several models were considered that were utilized in an analysis of endogenous technical change. The most promising model for future research was one which incorporated knowledge as a quasi-fixed factor within the cost of adjustment framework. ERA

N78-25597# International Institute for Applied Systems Analysis, Laxenburg (Austria).
WHICH WAY TO GO. OBSERVATIONS BASED ON DISCUSSION ON GLOBAL PERSPECTIVES AND ENERGY STRATEGIES
W. Sassin, A. Lovins (Friends of the Earth, London), D. Meadows (Dartmouth College, Hanover, N.H.), and P. Penczynski Sep. 1977 11 p
(IIASA-PP-77-9) Avail: NTIS HC A02/MF A01

The world's future energy supply and demand were discussed. Topics included: nuclear, large-scale solar, coal, renewable sources

in a total or regional context (like wind, wave power, biomass utilization, and small-scale solar heat) and energy conservation measures such as better insulation or the co-generation of electricity and process heat. ERA

N78-25598# Electric Power Research Inst., Palo Alto, Calif.
FORECASTING AND MODELING TIME-OF-DAY AND SEASONAL ELECTRICITY DEMANDS
Anthony Lawrence Dec. 1977 465 p refs Presented at the Workshop on Methodologies for Forecasting Time-of-Day and Seasonal Elec. Loads, Aspen, Colo., 30 Mar. - 1 Apr. 1977
(EPRI-EA-578-SR; Conf-770391) Avail: NTIS HC A20/MF A01

The papers presented are divided into three main categories: econometric papers that deal with modeling and forecasting an individual households' demand for electricity with time-of-day pricing; econometric and statistical time-series papers that deal with forecasting the peak load of utility systems; and papers that provide insights into previous experience with peak-load pricing, benefit/cost analysis, model specification, and experimental design related to load forecasting and load control. ERA

N78-25599# Blalock (S. D., Jr.), Kingsport, Tenn.
HEAT EXTRACTION SYSTEM OF THE PERM THERMAL ELECTRIC POWER PLANT
1977 11 p Transl. into ENGLISH of "The Design and Operation of Heat Extraction Systems of Thermoelectric Power Plants and Nuclear Power Plants", Joint Sov.-Am. Coord. Comm. Theme 08.0203 Inst. of the Min. of Energy of the USSR, Uralsk Affiliate, Moscow, 1977 p 1-13 Sponsored by DOE Prepared for ORNL
(ORNL-TR-4492) Avail: NTIS HC A02/MF A01

The basic equipment of the 4800 MW Perm coal-fired power plant in the Ural region, U.S.S.R., its water supply source, the once through cooling system, measures taken to prevent thermal pollution in the water reservoir and damage to fish at the water supply intake point, and the ash and cinder removal system at the plant are discussed. ERA

N78-25600# Battelle Columbus Labs., Ohio.
AGGLOMERATING BURNER GASIFICATION PROCESS: DESIGN, INSTALLATION, AND OPERATION OF A 25-TON-A-DAY PROCESS DEVELOPMENT UNIT. Monthly Progress Report, Dec. 1977
B. C. Kim, comp. 9 Jan. 1978 9 p
(Contract EX-76-C-01-1513)
(FE-1513-69; PR-59) Avail: NTIS HC A02/MF A01

Progress on the operation of the 25 ton per day coal gasification PDU to study the Agglomerating Burner Gasification Process is summarized. Also reported is work on the process engineering task and the activity on the turbine engineering study. One run was made with subbituminous coal. For the first time solids circulation was maintained at a sufficient rate to provide adequate heat to the gasifier from combustion of coal in the combustor. The system pressure during much of the run was 90 psig with one period of operation at the design pressure of 100 psig. This run was terminated prematurely because an asbestos gasket in the bottom head of the gasifier failed resulting in a leak that could not be repaired safely. A draft report on the process engineering and economic task is currently undergoing internal technical review. Fabrication of the erosion test rig is complete and ready for installation at the appropriate time. ERA

N78-25601# Foster Wheeler Corp., Livingston, N.J.
DEVELOPMENT WORK FOR AN ADVANCED COAL GASIFICATION SYSTEM FOR ELECTRIC POWER GENERATION FROM COAL DIRECTED TOWARD A COMMERCIAL GASIFICATION GENERATING PLANT, PHASE 2. VOLUME 12: COLD-FLOW MODEL TESTING OF A TWO-STAGE ENTRAINED-FLOW SLAGGING COAL GASIFIER
Dec. 1977 182 p
(Contracts EX-76-C-01-1521; Contract E(49-18)-1521)
(FE-1521-31) Avail: NTIS HC A09/MF A01

Qualitative information regarding the operating characteristics of the two-stage entrained-flow coal gasifier is presented, using a series of cold flow tests in a scale model of the proposed prototype gasifier. Common, unreacting substances were used to simulate the flow of anticipated components in the prototype, with air representing product gas, granulated cork representing both coal and char feeds, and glycerine simulating the flow of slag in the lower stage of the gasifier. The flow rates for these substances were determined by matching numerical values of various dimensionless groups in the model to those expected in the prototype. Aspects of the flow patterns in both stages were examined, including possible problem areas concerned primarily with refractory erosion, slag drainage, and particulate agglomeration. ERA

N78-25602# Foster Wheeler Corp., Livingston, N.J.
DEVELOPMENT WORK FOR AN ADVANCED COAL GASIFICATION SYSTEM FOR ELECTRIC POWER GENERATION FROM COAL DIRECTED TOWARD A COMMERCIAL GASIFICATION GENERATING PLANT, PHASE 2. VOLUME 14: SYSTEM ANALYSIS
Dec. 1977 151 p refs
(Contract EX-76-C-01-1521)
(FE-1521-33) Avail: NTIS HC A08/MF A01

A detailed computer model was developed for the system simulation of an integrated coal gasification combined-cycle pilot plant using an air-blown, two-stage, entrained flow, slagging gasifier. The pilot plant system is described by a system of partial differential and algebraic equations governing the energy, material, and momentum balance of the pilot plant. An implicit finite-difference scheme was used to discretize the partial differential equations in both the time and space domain. The resulting set of non-linear algebraic equations was solved by the method of successive iteration. Model developments of various subsystems and components are given in detail. Both steady-state and transient studies were carried out with the computer code in order to investigate pilot plant performance characteristics as well as component interface under various operation conditions. Specifically, steady-state, full and part-load operations were studied. ERA

N78-25603# National Bureau of Standards, Washington, D. C. Inst. for Materials Research.
MATERIALS RESEARCH FOR CLEAN UTILIZATION OF COAL Quarterly Progress Report, Jan. - Mar. 1977
S. J. Schneider Nov. 1977 69 p refs
(Contract EA-77-A-01-6010-002)
(FE-6010-11) Avail: NTIS HC A04/MF A01

Coal gasification processes require the handling and containment of corrosive gases and liquids at high temperatures and pressures, and also the handling of flowing coal particles in this environment. These severe environments cause materials failures which inhibit successful and long-time operation of the gasification systems. The project entails investigations on the wear, corrosion, chemical degradation, fracture, and deformation processes which lead to the breakdown of metals and ceramics currently being utilized in pilot plants. A system was initiated to abstract and compile all significant operating incidents from coal conversion plants. ERA

N78-25604# Kentucky Univ., Lexington.
SURFACE STRUCTURE AND MECHANISMS OF GASIFICATION CATALYST DEACTIVATION Quarterly Report, May - Jul. 1977
P. J. Reucroft, E. B. Bradley, R. J. DeAngelis, and G. A. Sargent Oct. 1977 68 p refs
(Contract EX-76-C-01-2229)
(FE-2229-6) Avail: NTIS HC A04/MF A01

The ESCA instrument was moved into a new facility and extensive modifications for safety purposes were made. The electron flood gun was tested with mixed results. NiSO4 was observed to have a significantly different ESCA spectrum from NiS. It was observed that silica supported NiO was easily reduced by the standard Argon ion etching procedure while alumina supported NiO was much more resistant to reduction. Infrared spectra of NiO/MgSiO3 catalysts show that CO3/sup equals/ is adsorbed as was observed for alumina-and-silica-support catalysts. The MgSiO3 support produces infrared absorption which is almost identical to NiSiO3 except for some doublet structure. Adsorption studies of C2H2 over NiO/Al2O3 indicate that CH2 and CH3 species are formed in the 300 C temperature region. Suitable procedures were developed to stabilize the reduced nickel catalysts and prevent the spontaneous re-oxidation by passivation

during examination by X-ray diffraction. The chemisorption of air and CO on a sulfided catalyst surface was investigated at room temperature. ERA

N78-25605# Oak Ridge National Lab., Tenn.
COAL TECHNOLOGY PROGRAM Progress Report, Oct. 1977
Dec. 1977 48 p refs
(Contract W-7405-eng-26)
(ORNL-TM-6137) Avail: NTIS HC A03/MF A01

Blocks of Pittsburgh seam bituminous coal were pyrolyzed under reducing gas in the project in support of in situ gasification. Higher heating rates appear to reduce swelling of the block during pyrolysis, and higher final pyrolysis temperature results in lower boiling tars. Three pressurized residue carbonization tests were completed at 1100 F and 400 psi of methane with three feed materials. Modifications to experimental techniques were made to allow the heat treatment of tension specimens and simulated heat treatment of thick plate sections. Exposure of heat exchanger tubes in the Fluidyne Corporation atmospheric fluidized bed has reached a maximum of 1500 hr. Tube samples were recovered. In the gas-fired potassium boiler project, three preliminary runs of short duration were made in which the boiler was filled with potassium and heated up to or near the boiling temperature with the main burner. Operating problems that were encountered in these runs were resolved. ERA

N78-25606# Argonne National Lab., Ill.
NONDESTRUCTIVE EVALUATION NEEDS FOR COAL LIQUEFACTION
D. S. Kupperman Sep. 1977 47 p refs
(Contract W-31-109-eng-38)
(ANL-77-61) Avail: NTIS HC A03/MF A01

Nondestructive evaluation was highly rated in importance as a way to help alleviate problems in coal-conversion systems. The primary problems were associated with highly erosive and corrosive slurries being transferred throughout the coal-conversion process. Applicable NDE techniques for both preservice and in-service inspection include high-temperature ultrasonics, acoustic emission, radiography, acoustic holography, and ultrasonic spectroscopy. ERA

N78-25607# Oklahoma State Univ., Stillwater. Dept. of Chemistry.
MASS SPECTROMETRIC ANALYTICAL SERVICES AND RESEARCH ACTIVITIES TO SUPPORT COAL-LIQUID CHARACTERIZATION RESEARCH Annual Progress and Quarterly Report, 9 Mar. - 8 Jun. 1977
S. E. Scheppele Sep. 1977 47 p refs
(Contract EY-76-S-02-0020)
(COO-0020-8) Avail: NTIS HC A03/MF A01

Ion-source temperature markedly affects the sensitivity for field ionization of saturated hydrocarbons relative to sensitivity for FI of aromatic hydrocarbons. Using relative FI sensitivities determined for a number of organic compounds over a range of temperatures, excellent analytical data were obtained for a test mixture. Field-ionization mass spectrometry constitutes an ideal technique for group-type analysis of saturated hydrocarbons, and mixtures of saturated and aromatic hydrocarbons providing FI/MS are obtained with adequate resolution. Implementation of computer-assisted data reduction, correlation, and interpretation focused on converting mass spectral ion abundance data for a given gel-permeation chromatography (GPC) fraction into quantitative distributions and conversion of the data for the various fractions into distributions for the total sample. High-resolution 70-eV electron-impact mass spectra were recorded for 56 fractions obtained from separation of a tar sand sample on photographic plates. ERA

N78-25608# Mobil Research and Development Corp., Paulsboro, N. J. Process Research and Technical Service Div.
UPGRADING OF COAL LIQUIDS FOR USE AS POWER GENERATION FUELS Annual Report, Feb. 1976 - Jan. 1977
T. R. Stein, J. G. Bendoraitis, A. V. Cabal, R. B. Callen, M. J. Dabkowski, R. H. Heck, H. R. Ireland, and C. A. Simpson Oct. 1977 146 p refs
(EPRI-AF-444) Avail: NTIS HC A07/MF A01

The hydroprocessing of coal liquids (derived from the H-Coal and SRC processes) in fixed bed pilot units using commercially available catalysts is described. Distillate coal liquids were upgraded to the quality levels of existing petroleum-derived turbine fuels. Hydrogen consumption and processing severity depends upon the hydrogen and nitrogen contents of the feed. Product quality (e.g., heteroatom and aromatic content) was quantified in terms of process conditions by a kinetic reaction model. The distillate coal liquids were compatible with petroleum-derived fuels. Hydroprocessing of the non-distillable SRC product/process solvent (SRC) blends removed up to 90 wt.% of the heteroatoms and converted large quantities of the SRC to lower boiling, less aromatic material suitable as turbine fuel. Severe hydroprocessing is required to significantly improve the compatibility of SRC with heavy petroleum fuel. ERA

N78-25609# Princeton Univ., N. J. Dept. of Aerospace and Mechanical Sciences.
OPTIMIZATION OF PYROLYTIC CONVERSION OF COAL TO CLEAN FUEL Quarterly Report, Jan. - Mar. 1977
H. L. Friedman, M. J. Antal, Jr., T. J. Ohlemiller, R. L. Derham, and M. Summerfield 15 Apr. 1977 24 p refs
(Contract EX-76-C-01-2253)
(FE-2253-5) Avail: NTIS HC A02/MF A01

Computer programs were perfected to obtain kinetic parameters from thermogravimetry of coals heated at several linear rates of temperature rise, and were applied to Wyodak coal with success. Program development is underway to model the fixed bed coal pyrolysis reactor, and to combine thermogravimetry and differential scanning calorimetry for better understanding of the mechanism of pyrolysis and to get more accurate kinetic equations and parameters. Experimental activities included the following: the chemical data systems pyrolysis/gas chromatography/peak identifier system was studied further to select the specific method of its application to this research. Four coals were pyrolyzed under identical conditions and gas chromatography curves were obtained and were compared. Calibration samples are currently being run and are being compared with results of pyrolysis. ERA

N78-25610# Brookhaven National Lab., Upton, N. Y. Process Sciences Div.
REGENERATIVE PROCESS FOR DESULFURIZATION OF HIGH TEMPERATURE COMBUSTION AND FUEL GASES Quarterly Progress Report, 1 Apr. - 30 Jun. 1977
M. Steinberg and R. T. Yang 1977 28 p refs
(Contract EY-76-C-02-0016)
(BNL-50706; QPR-5) Avail: NTIS HC A03/MF A01

The sulfation rate of reagent-grade monocalcium silicate is of the same order of magnitude as that of limestone and higher than that of reagent-grade calcium oxide. Construction of a micro-pilot rotary kiln for regeneration of lime from the sulfated lime was completed. Design and construction of a micro-combustor used to test the regenerated lime are underway. Studies on sulfation of lime continue. The catalysis by Fe_2O_3 and/or coal ash was established and its mechanisms were studied. A process flow diagram for producing commercial strength sulfuric acid from regenerator off-gas was prepared. A preliminary comparison between a once through sorbent system and the combined regenerative/H_2SO_4 system indicates that the net energy outputs (useful) of the two systems are approximately the same. The quantity of solid wastes generated by the once through system is about 2.5 times the quantity generated by the combined system. ERA

N78-25611# Bituminous Coal Research, Inc., Monroeville, Pa.
GAS GENERATOR RESEARCH AND DEVELOPMENT, BI-GAS PROCESS Interim Report, 1 Jul. 1976 - 30 Jun. 1977
Aug. 1977 344 p refs Prepared in cooperation with Phillips Petroleum Co., Homer City, Pa.
(Contracts EX-76-C-01-1207; EF-77-C-01-1207)
(FE-1207-33; BCR-L-828) Avail: NTIS HC A15/MF A01

Work continued on the evaluation of fluidized-bed methanation catalysts at both the bench-scale and PEDU-scale levels. In addition, assistance was given in planning, acquisition, and assessment of the BI-GAS pilot plant operation data. Bench-scale studies included four standard life tests and one extended life

test to evaluate experimental fluidized-bed methanation catalysts. ERA

N78-25612# Arizona State Univ., Tempe.
SOLAR ENERGY CONVERSION: AN ANALYSIS OF IMPACTS ON DESERT ECOSYSTEMS Progress Report, 1 Jun. - 31 Dec. 1977
Duncan T. Patten Sep. 1977 44 p refs
(Contract EC-77-S-02-4339)
(COO-4339-1) Avail: NTIS HC A03/MF A01

Some of the important potential ecological impacts that might occur when solar collector arrays are constructed and maintained in the desert Southwest are discussed. These impacts are categorized under major environmental consequences of solar collector development, that is, shading wind deflection and site destruction, and soil disturbance. Under these major categories secondary impacts are developed to show the significance of altering desert ecosystems with solar conversion systems. Some of the secondary impacts which include abiotic changes in radiation, temperature, heat flux, soil moisture and erosion, and biotic changes such as increased plant productivity and species diversity are discussed as to their short and long term significance in the desert system. A brief description of the solar collector simulator array being constructed in the desert to test many of the concepts developed during the early part of Phase 1 of this project is presented. ERA

N78-25613# Atomics International, Canoga Park, Calif.
COMMERCIAL APPLICATIONS OF SOLAR TOTAL ENERGY SYSTEMS Quarterly Progress Report, 1 Nov. 1976 - 31 Jan. 1977
Sep. 1977 156 p refs
(Contracts EY-76-C-03-1210; E(04-3)-1210)
(AI-ERDA-13203; QPR-3) Avail: NTIS HC A08/MF A01

The application of Solar Total Energy System (STES) to the commercial sector stores is discussed. Candidate solar-thermal and solar-photovoltaic concepts are considered for providing on-site electrical power generation as well as thermal energy for both heating and cooling applications. The solar-thermal concepts include the use of solar concentrators (distributed or central-receiver) for collection of the thermal energy for conversion to electricity by means of a Rankine-cycle or Brayton-cycle power conversion system. Recoverable waste heat from the power generation process is utilized to help meet the building thermal energy demand. Evaluation methodology is identified to allow ranking and/or selection of the most cost effective concept for commercial building applications. ERA

N78-25614# Bechtel Corp., San Francisco, Calif.
BATTERY STORAGE PERFORMANCE REQUIREMENTS FOR TERRESTRIAL SOLAR PHOTOVOLTAIC POWER SYSTEMS Final Report
Aug. 1977 306 p refs Prepared for ANL, Argonne, Ill.
(Contract W-31-109-eng-38)
(ANL/OEPM-77-3) Avail: NTIS HC A14/MF A01

A broad spectrum of terrestrial photovoltaic applications was evaluated by considering the types of loads served and the characteristics of system components. Low, intermediate, and high power systems, such as used in a single residence, a multiple residence, a shopping center or a central station power plant were studied. A computer program was developed to assist in determining battery voltages and currents during operation of the photovoltaic systems. Modeling was limited to single-crystal silicon solar cells and the characteristics of a Li-Al/FeS battery. Battery requirements for this application are generally no more severe than for other battery applications and, in some respects (e.g., energy density), may be less severe. Specific conclusions and recommendations are presented. System requirements and battery capabilities are summarized in tabular form. ERA

N78-25615# George Washington Univ., Washington, D. C. Behavioral Studies Group.
ANALYSIS OF POLICY OPTIONS FOR ACCELERATING COMMERCIALIZATION OF SOLAR HEATING AND COOLING SYSTEMS
Roger Bezdek, Joseph Margolin, Thomas Sparrow, George Sponsler, Allan Miller, Fred Meeker, Arthur Ezra, Robert Spongberg, Elliot Roseman, and Marion Misch Apr. 1977 475 p refs
(TID-27597; HCP/M2534-02) Avail: NTIS HC A20/MF A01

Feasible policy options designed to accelerate the commercialization of solar heating and cooling (SHAC) systems are described and analyzed. Both qualitative and quantitative estimates of the costs/benefits of different policy options were made. The critical problem of interfacing dispersed SHAC systems with the public utilities was analyzed. A comprehensive discussion of the legal, regulatory, and institutional problems confronting the rapid commercialization of SHAC systems is presented. The complex problems involved in building codes, standards, and warranties are discussed. Marketing, manpower, consumer, and environmental issues are analyzed. ERA

N78-25616# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.
SOLAR PILOT PLANT PROJECT REVIEW NO. 9, 4-5 MAY 1977
1977 470 p
(Contract EY-76-C-03-1109)
(SAN/1109-8) Avail: NTIS HC A20/MF A01

Drawings and illustrations for the project review are presented. These are included for the 10 MW(e) solar pilot plant, the collector subsystem, the receiver subsystem, the electrical power generation system and balance of plant, plant controls and transient analysis, availability and safety, pilot and commercial plant designs, and summary and recommendations. ERA

N78-25617# Michigan Technological Univ., Houghton.
ENERGY AND PROTEIN PRODUCTION FROM PULP MILL WASTES Progress Report, 15 Sep. - 15 Dec. 1977
M. F. Jurgensen and J. T. Patton 15 Dec. 1977 9 p
(Contract EY-76-C-02-2983)
(COO-2983-6) Avail: NTIS HC A02/MF A01

The conversion of the protein production experiments from batch to continuous operation, and the identification of growth stimulants to increase methane yield were studied. Yeast production ranging from 0.5 to 5.0 grams of dry yeast per liter were obtained in batch cultures. Highest yields were consistently attained on SSL (spent sulfite liquor). Continuous fermentation studies using three hour ozonated SSL confirmed the characteristic yields demonstrated in previous batch tests. Contamination, which occurred at residence times less than two days, appeared to decrease protein production rate and yield. Vitamins and minerals, fatty acids, and low molecular weight alcohols were investigated as possible stimulants for methane production. ERA

N78-25618# General Electric Co., Philadelphia, Pa. Space Div.
SOLAR TOTAL ENERGY; LARGE SCALE EXPERIMENT. NO. 2, PHASE 2: CONCEPTUAL DESIGN Final Report
12 Jan. 1978 593 p
(Contract ENG-77-C-04-3985)
(TID-27995; DOC-78SDS4200) Avail: NTIS HC A25/MF A01

The selected system incorporates a distributed collector/central generation system using parabolic dish collectors. A steam Rankine cycle power conversion system with extraction turbine/backpressure and condensing was selected. Therminol 66 will be the baseline heat transfer fluid for the solar collector field and thermal energy storage system (a rock and trickle oil system). Two-tank pressurized water storage will be used for low-temperature storage. A site requirements analysis is presented including site description, insolation methodology, and load analysis. A life-cycle cost analysis, energy displacement analysis, legal compliance study, health and safety analysis, environmental assessment, and utilities interface study are included. The overall project plan including schedules and costs is presented. ERA

N78-25619# Resource Planning Associates, Inc., Washington, D. C.
INSTITUTIONAL APPLICATIONS OF SOLAR TOTAL ENERGY SYSTEMS Quarterly Progress Report
Jul. 1977 177 p refs
(Contract EG-77-C-04-3786)
(ALO/3786-1; QPR-1) Avail: NTIS HC A09/MF A01

The meteorology followed to develop a data base for assessing market potential in the eight institutional subsectors is described.

The subsectors are: elementary and high schools, colleges, and universities, hospitals, military installations, public administration buildings, post offices, airports, and prisons. The market characteristics to be studied in detail are defined, and the methodology to be followed in assessing the relative economic performance of representative STE systems is given. ERA

N78-25620# Sandia Labs., Albuquerque, N. Mex.
PRELIMINARY ECONOMIC ANALYSIS OF SOLAR IRRIGATION SYSTEMS (SIS) FOR SELECTED LOCATIONS
L. L. Lukens, A. M. Perino, and S. G. Vandevender Nov. 1977 52 p
(Contract EY-76-C-04-0789)
(SAND-77-1403) Avail: NTIS HC A04/MF A01

The economic feasibility was determined by comparing the life cycle cost (LCC) of the solar system to the LCC of conventional systems. The systems analyzed were point studies and do not represent either worst case or best case conditions. Therefore, general conclusions should not be drawn on the results presented here. The results show that for these cases, economic feasibility is dependent on utilization of the SIS for production of energy in addition to that required to water crops. ERA

N78-25621# Clemson Univ., S.C. College of Engineering.
FEASIBILITY EVALUATION: SOLAR HEATED TEXTILE PROCESS WATER Semiannual Progress Report, Jul. 1975 - Feb. 1976
J. C. Hester Dec. 1977 26 p
(Contract EY-76-S-09-0885)
(SRO-0885-75/1) Avail: NTIS HC A03/MF A01

The technical and economic feasibility of the use of solar energy for heating waters in the textile industry and to develop a plan for efforts beyond this feasibility study phase are reported. Specific objectives include (1) determine the industry requirements for heated process water, (2) assess particular schemes and their economic impact, (3) study the total cost environment for solar water heating in this industry, and (4) recommend future experiments. Major progress was made in terms of collaboration with textile firms, user needs, and dissemination of results. Software for facilitating the design of potential systems has reached an intermediate stage of development. The cost environment was probed and is being systematically documented. Long-term economic impact programs are in the advanced stage of development. Areas of future effort are prescribed. ERA

N78-25622# Massachusetts Inst. of Tech., Cambridge.
DESIGN METHODOLOGIES FOR ENERGY CONSERVATION AND PASSIVE HEATING OF BUILDINGS UTILIZING IMPROVED BUILDING COMPONENTS Progress Report, 1 Aug. - 31 Oct. 1977
J. Habraken and Timothy E. Johnson Oct. 1977 8 p
(Contract EG-77-S-02-4513)
(COO-4513-1) Avail: NTIS HC A02/MF A01

Construction of the experimental building demonstrating light weight ceiling thermal storage tiles, transparent insulation assemblies, and specialized louvers is underway. A superior heat mirror product is being used in place of the original proposed transparent insulation for the south windows. Negotiations are underway to acquire superior logging devices for monitoring the building. ERA

N78-25623# Oak Ridge National Lab., Tenn.
EXPERIMENTAL STUDY OF HEAT TRANSFER ENHANCEMENT FOR AMMONIA CONDENSING ON VERTICAL FLUTED TUBES
S. K. Combs Jan. 1978 128 p refs
(Contract W-7405-eng-26)
(ORNL-5356) Avail: NTIS HC A07/MF A01

Experiments were run to determine heat transfer performance of single vertical tubes with ammonia condensing on the outside. The four test tubes (aluminum) were of 1 in. nominal diameter and 4 ft length with 0 (smooth), 24, 48, and 60 external flutes. Test parameter ranges are given. The condensing heat transfer coefficients are reported as composite coefficients that include the resistance of both the condensing side and the tube wall. All parameters were based on total condensing surface area. The data show that, for a given heat flux, a fluted tube can increase condensing coefficients by up to 7.2 times smooth tube values. ERA

N78-25624# Institute of Gas Technology, Chicago, Ill.
APPLICATION ANALYSIS OF SOLAR TOTAL ENERGY TO THE RESIDENTIAL SECTOR Quarterly Technical Status Report, 1 Apr. - 30 Jun. 1977
T. Whaley, B. Yudow, N. Malik, and L. Korobkin Aug. 1977 207 p refs
(Contract EG-77-C-04-3787)
(TID-28103) Avail: NTIS HC A10/MF A01

A solar total energy system (STES) is defined as an energy system designed to maximize the efficient use of collected solar energy by supplying both the low grade (low temperature thermal) and high grade (electrical and/or mechanical) energy needs of selected applications. ERDA's Solar Total Energy Program is concerned primarily with those solar total energy systems that use heat engine or photovoltaic devices to produce electricity (and/or mechanical work) and apply the residual thermal energy from the conversion process to some useful purpose. ERA

N78-25625# Resource Planning Associates, Inc., Washington, D. C.
INSTITUTIONAL APPLICATIONS OF SOLAR TOTAL ENERGY SYSTEMS Quarterly Report
Oct. 1977 86 p refs Prepared in cooperation with Intertechnology Corp., Warrenton, Va.
(Contract EG-77-C-04-3786)
(TID-22782; QR-2) Avail: NTIS HC A05/MF A01

The applicability of solar energy (STE) systems is being analyzed in the industrial, commercial, residential, and institutional building sectors. The applications analysis is being conducted in the institutional sector, which has been defined to include eight subsectors: hospitals, primary and secondary schools, colleges, and universities, public-administration buildings, military installations, prisons, post offices, and airports. The three major components of the study are: (1) a market assessment, (2) the development of conceptual designs, and (3) an examination of federal policies aimed at speeding the commercialization of STE systems. ERA

N78-25626# Argonne National Lab., Ill. Chemical Engineering Div.
DEPENDENCE OF THE SOLAR ABSORPTANCE OF SELECTIVE ABSORBER COATINGS ON THE ANGLE OF INCIDENCE
Kent A. Reed 1977 4 p ref Presented at the Concentrating Solar Collector Conf., Atlanta, 26-28 Sep. 1977
(Contract W-31-109-eng-38)
(CONF-770953-8) Avail: NTIS HC A02/MF A01

The directional solar absorptances of samples of a number of selective absorber coatings were determined. The spectral directional hemispherical reflectances of each sample were measured over the wavelength range 0.3 micron to 2.5 microns at angles of incidence theta between 10 deg and 80 deg. The quantity was convoluted over an AM2 solar spectrum to obtain alpha/sub s/(theta) at each angle of incidence. The solar absorptance at near normal incidence varied from sample to sample and from coating to coating, as expected, given the present state of the art. All the absorptances show similar angular dependences. When normalized to unity at normal incidence, the data nearly describe a single curve, for which a power series in theta was found. For comparison, the solar absorptance was also determined for freshly prepared lamp black. ERA

N78-25627# Argonne National Lab., Ill.
PERFORMANCE AND TESTING OF A STATIONARY CONCENTRATING COLLECTOR
R. L. Cole, J. W. Allen, N. M. Levitz, W. R. McIntire, and W. W. Schertz 1977 11 p Presented at the Concentration Solar Collector Conf., Atlanta, 26-28 Sep. 1977
(Contract W-31-109-eng-38)
(CONF-770953-7) Avail: NTIS HC A02/MF A01

The development of nonimaging solar collectors for heating and cooling applications is reported. A totally stationary concentrating collector has been designed, built, and tested. The collectors employ compound parabolic concentrators coupled to tubular evacuated receivers. Performance of the collector is substantially

better than flat plate collectors, and the collectors are suitable for powering mechanically driven air conditioning systems as well as conventional absorption cycle machines. ERA

N78-25628# Argonne National Lab., Ill. Chemical Engineering Div.

CPC THERMAL COLLECTOR TEST PLAN

Kent A. Reed 1977 5 p refs Presented at the Concentrating Solar Collector Conf., Atlanta, 26-28 Sep. 1977

(Contract W-31-109-eng-38)

(CONF-770953-6) Avail: NTIS HC A02/MF A01

A comprehensive set of test procedures were developed for establishing the performance of compound parabolic and concentrating thermal collectors with large angular fields of view. The procedures range from separate thermal and optical tests, to overall performance tests. A calorimetric ratio technique was designed to determine the heat output of a collector without knowledge of the heat transfer fluid's mass flow rate and heat capacity. Special attention was paid to the problem of defining and measuring the incident solar flux with respect to which the collector efficiency was calculated. ERA

N78-25629# Argonne National Lab., Ill. Chemical Engineering Div.

CONCEPTUAL DESIGN OF A 5x CPC FOR SOLAR TOTAL ENERGY SYSTEMS

R. L. Cole, W. W. Schertz, and W. P. Teagan (Little, Arthur D., Inc., Cambridge, Mass.) 1977 13 p refs Presented at the Concentrating Solar Collector Conf., Atlanta, 26-28 Sep. 1977

(Contract W-31-109-eng-38)

(CONF-770953-5) Avail: NTIS HC A02/MF A01

The results of a conceptual design of a nontracking collector for a solar total energy system are described. A cycle turbine, generator, controls, thermal storage, and air conditioning equipment were installed and tested. The thermal energy for the facility is to be provided by a large concentrating collector field. A portion of the area is installed as E-W oriented linear parabolic troughs. Three additional concepts for the remaining area were selected; a fixed mirror-moving receiver system; fixed receiver-moving reflector slats; and a two-axis tracking parabolic dish. All four systems use diurnal tracking and have the reflecting surfaces exposed to the elements. ERA

N78-25630# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.

SOLAR TOTAL ENERGY; LARGE SCALE EXPERIMENT. PHASE 2: FORT HOOD, TEXAS Final Technical Progress Report

J. J. Buggy Sep. 1977 500 p refs

(Contract EG-77-C-04-3988)

(TID-18040) Avail: NTIS HC A21/MF A01

Descriptions of the application, the selected Conceptual Design, and the performance of the system, as well as documentation of the major supporting studies that led to selection of the concept are presented. The approach consisted basically of a detailed definition of the specific design requirements which included a description of the interface connections with the existing Ft. Hood Building Complex. Equipment availability which could satisfy, in a practical way, the general system configuration requirements was evaluated. Real equipment designs or design alternates were then selected to form the basis for the concept design analysis, selections and sizing. Power conversion system concepts were developed that provided the design summer day and winter day thermal requirements. These concepts included both single and dual turbine systems, and in the case of dual turbine systems, both series and parallel arrangements were investigated. A complete site description, environmental impact study, and life-cycle cost analysis are included. ERA

N78-25631# Sandia Labs., Albuquerque, N. Mex.

VERTICAL AXIS WIND TURBINE TIE-DOWN DESIGN WITH AN EXAMPLE

R. C. Reuter, Jr. Dec. 1977 35 p refs

(Contract EY-76-C-04-0789)

(SAND-77-1919) Avail: NTIS HC A07/MF A01

Design of cable tie-down systems for vertical axis wind turbines (VAWT) is discussed and guidelines are furnished. Topics such as the number, size and material of the cables, cable elevation angle, tensioning, and thermoelastic effects are discussed in detail. The tiedown system of an existing 17 meter VAWT is used throughout as a numerical example. ERA

N78-25632# Sandia Labs., Albuquerque, N. Mex. Aerodynamics Div.

FREE-AIR PERFORMANCE TESTS OF A 5-METRE-DIAMETER DARRIEUS TURBINE

R. E. Sheldahl and B. E. Blackwell Dec. 1977 36 p refs

(Contract EY-76-C-04-0789)

(SAND-77-1063) Avail: NTIS HC A03/MF A01

The results of these tests and some of the problems associated with free air testing of wind turbines are presented. The performance data obtained follow the general trend of data obtained in extensive wind tunnel tests of a 2 meter diameter turbine. However, the power coefficient data are slightly lower than anticipated. The reasons for this discrepancy are explored along with comparisons between experimental data and a computerized aerodynamic prediction model. ERA

N78-25633# California Univ., Berkeley. Lawrence Berkeley Lab.

STUDY OF BRINE TREATMENT Final Report

Sidney L. Phillips, Ashwani K. Mathur, and Raymond E. Doebler Nov. 1977 253 p refs

(Contract W-7405-eng-48; Proj. 791-1)

(EPRI-ER-476; LBL-6371) Avail: NTIS HC A12/MF A01

Information pertinent to the treatment of geothermal brines was collected by literature search and then evaluated and summarized for use by the electric and geothermal industries. The information was screened from the geothermal, oil and gas, wastewater disposal, and boiler water treatment industries. The current state of knowledge and methodology concerning the treatment of geothermal brines to control scaling and corrosion in geothermal electric power production was assessed. Currently, geothermal scale in pipes and wells is removed by physical or chemical methods. There is a growing effort on developing methods to control scale formation for both fresh and spent brines, including pH adjustment and application of an electrical potential for fresh fluids, and coagulation to treat spent fluids. Current methods of corrosion control center around planned replacement of piping and other plant components, with efforts focused primarily on development of materials with improved corrosion resistance. ERA

N78-25634# California Univ., Livermore. Lawrence Livermore Lab.

PRELIMINARY TESTS USING A LASER PARTICLE-SIZE ANALYZER ON GEOTHERMAL BRINE

J. Grens 18 Nov. 1977 18 p refs

(Contract W-7405-eng-48)

(UCID-17637) Avail: NTIS HC A02/MF A01

A laser light-scattering particle-size analyzer was used for a two-day period under limited field conditions to observe the occurrence and growth of particles in geothermal brines. Tests were conducted under conditions where both pH and rate of cooling to room temperature strongly influence the size and nature of the particulate population, with a low (4.5) pH and rapid quenching favoring slow growth rates. A method for estimating particulate mass in time periods shorter than 6 h from quenching is presented. Some implications for sampling and solids analysis are discussed. ERA

N78-25635# California Univ., Livermore. Lawrence Livermore Lab.

POTENTIAL GROWTH OF ELECTRIC POWER PRODUCTION FROM IMPERIAL VALLEY GEOTHERMAL RESOURCES

D. L. Ermak Sep. 1977 33 p refs

(Contract W-7405-eng-48)

(UCRL-52252) Avail: NTIS HC A03/MF A01

The growth of geothermal electric power operations in Imperial Valley, California is projected over the next 40 years. With commercial power forecasts to become available in the 1980's, the scenario considers three subsequent growth rates: 40, 100, and 250 MW per year. These growth rates, along with estimates of the total resource size, result in a maximum level of electric power production ranging from 1000 to 8000 MW to be attained in the 2010 to 2020 time period. Power plant siting constraints

are developed and used to make siting patterns for the 400 through 8000 MW level of power production. Two geothermal technologies are included in the scenario: flashed steam systems that produce cooling water from the geothermal steam condensate and emit noncondensable gases to the atmosphere; and high pressure, confined flow systems that inject the geothermal fluid back into the ground. ERA

N78-25636# California Univ., Livermore. Lawrence Livermore Lab.
REMOVAL OF SILICA FROM SPENT GEOTHERMAL BRINE
Richard W. Ryon and John H. Hill Dec. 1977 8 p refs
(Contract W-7405-eng-48)
(UCID-17702) Avail: NTIS HC A02/MF A01

Preliminary survey experiments conducted at the LLL Salton Sea Geothermal Test Site in April and May, 1977 are reported. The addition of caustic to raise the brine pH to approximately 6 precipitated silica and other materials. The addition of flocculating agents, such as ferric hydroxide, aids settling and filtration. Small-scale pilot plant studies are recommended. ERA

N78-25637# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
RESOURCE, TECHNOLOGY, AND ENVIRONMENT AT THE GEYSERS
Oleh Weres, Karen Tsao, and Byron Wood Jun. 1977 348 p refs
(Contract W-7405-eng-48)
(LBL-5231) Avail: NTIS HC A15/MF A01

A general review, description, and history of geothermal development at the geysers is presented. Particular emphasis is placed on environmental impacts of development of the area. The discussion is presented under the following chapter titles: introduction; energy, enthalpy and the First Law; vapor-producing geothermal reservoirs-review and models; geothermal; entropy and the Second Law; power plants-basics; H2S emissions; hydrogen sulfide-possible health effects and odor; other emissions; power plant hydrogen sulfide abatement; hot water based geothermal development; phytotoxicity of geothermal emissions; appendices; and bibliography. ERA

N78-25638# Biphase Engines, Inc., Santa Monica, Calif.
INVESTIGATION OF CLEAN WATER TEST SITES PROTOTYPE TURBOMACHINERY
Donald J. Cerini 5 Jan. 1978 29 p Prepared for Calif. Univ., Livermore. Lawrence Livermore Lab.
(Contract W-7405-eng-48)
(UCRL-13806) Avail: NTIS HC A03/MF A01

Expanded development of total-flow expander technology in order to obtain efficient energy extraction from the liquid flow component of the geothermal well flow, in addition to steam enthalpy conversion, was undertaken. The flow conditions necessary for this type of complete system performance characterization were beyond the capabilities of the test facility utilized in the preliminary tests. As an alternative to increasing the existing facility to meet the expanded test requirements, test facilities in the industrial California community are being surveyed to assess their capability in supporting future tests. The results of the survey are described, which includes a listing of all organizations contacted. The affirmative responses to the test-support requirement are detailed with a description of the test facility, range of operating conditions, facility modifications and auxiliary equipment required and costs thereof, and testing schedule costs. ERA

N78-25639# Babcock and Wilcox Co., Alliance, Ohio.
EVALUATION OF DEVOLATILIZATION CONCEPT Final Report
R. K. Bhada, R. H. Boll, A. J. Kubasco, and W. L. Sage Dec. 1977 209 p refs
(EPRI Proj. 523-1)
(EPRI-AF-608) Avail: NTIS HC A10/MF A01

The concept of increasing gas heating value from an air-blown entrained gasifier by feeding some or all of the coal to a devolatilizer vessel downstream of the gasifier was evaluated. A pilot plant was constructed consisting of a one foot diameter gasifier and an eight inch I.D. by eight feet high devolatilizer. A total of forty-three test runs were conducted using an eastern bituminous coal as well as a western subbituminous coal. Three modes of operation were employed; all coal feed to the gasifier, all coal feed to the devolatilizer, and a 50 to 50 split between the two. The results of the analysis of the pilot plant data are presented. ERA

N78-25640# Argonne National Lab., Ill.
INSTRUMENTATION AND PROCESS CONTROL FOR FOSSIL DEMONSTRATION PLANTS Quarterly Technical Progress Report, Apr. - Jun. 1977
E. F. Bennett, C. E. Cohn, S. A. Cox, L. R. Dates, R. W. Doering, D. Duffey, E. F. Groh, C. L. Herzenberg, L. W. Kirsch, W. W. Managan et al Jul. 1977 97 p refs
(Contract W-31-109-eng-38)
(ANL/FE-49622-9) Avail: NTIS HC A05/MF A01

Work was performed on updating the study of the state-of-the-art of instrumentation for fossil demonstration plants (FDP), development of mass-flow and other on-line instruments for FDP, process control analysis for FDP, and organization of a symposium on instrumentation and control for FDP. A solid gas flow test facility under construction for instrument development, testing, evaluation, and calibration is described. The development work for several mass-flow and other on-line instruments is described: acoustic flowmeter, capacitive density flowmeter, neutron activation flowmeter and composition analysis system, gamma ray correlation flowmeter, optical flowmeter, and capacitive liquid interface level meter. ERA

N78-25641# Daystar Corp., Burlington, Mass.
SOLAR ENERGY IN HIGH-RISE BUILDINGS
Oct. 1977 86 p refs
(Contract EA-77-X-01-1963)
(DSE/1963-1) Avail: NTIS HC A05/MF A01

An 88 collector solar domestic hot water system was installed during the summer of 1976 on a subsidized elderly housing project in Brookline, Massachusetts. No government funding or support of any kind was associated with this installation which is believed to be the largest multi-family high-rise (16 stories) solar domestic hot water system in the USA. This case study report of the project was prepared as a guide for similar programs. A summary of the events which occurred in the proposal and and approval phase of the project is included in addition to interviews with individuals who were involved in the decision-making process. Also included are a copy of the proposal used in selling the project, photographs of the completed system, and other support materials developed and utilized in marketing this project. ERA

N78-25642# Sandia Labs., Livermore, Calif.
ANALYSIS OF THE THERMAL FATIGUE INDUCED BY DNB OSCILLATIONS IN THE MDAC ROCKETDYNE PILOT AND COMMERCIAL PLANT SOLAR RECEIVER DESIGNS
J. F. Jones, Jr. and D. L. Siebers Dec. 1977 49 p refs
(Contract EY-76-C-04-0789)
(SAND-77-8283) Avail: NTIS HC A03/MF A01

A theoretical investigation is presented of the high cycle fatigue damage that may result from temperature oscillations in the boiler tube wall around the location of the point of departure from nucleate boiling (DNB) in a receiver subsystem for the pilot and commercial solar power plants. The problem was analyzed using the SAHARA and HEATMESH heat transfer codes and the GNATS structural analysis code. The results of the structural analysis show that fatigue damage due to DNB oscillations will not be a substantial problem in the pilot plant, but may cause a significant reduction in the life of the commercial receiver. It was found, however, that the results are highly dependent on the nature of the internal flow characteristics. ERA

N78-25643# Institute of Gas Technology, Chicago, Ill.
APPLICATION ANALYSIS OF SOLAR TOTAL ENERGY TO THE RESIDENTIAL SECTOR Quarterly Technical Status Report, 1 Oct. - 31 Dec. 1977
T. Whaley, B. Yudow, N. Malik (GKC), M. Gamze (GKC), B. Foster, T. Goff, J. Wurm, D. Deyoe (S. Cal. Gas), and G. Smith (Honeywell) Jan. 1978 287 p refs
(Contract EG-77-C-04-3787; IGT Proj. 8987)
(TID-28104) Avail: NTIS HC A13/MF A01

The application of solar total energy to appropriate segments of the residential sector, the market penetration potential for STE systems, and criteria for selecting suitable demonstration sites throughout the United States are presented. Concentration of single-family houses, townhouses, lowrise apartments, and high-rise apartments were projected to the 1980-1990 time frame for eleven regions of the country. The performance of both a low temperature system and a high-temperature system was analyzed by a computer program that simulates hourly performance of the conceptual STES designs. ERA

N78-25644# Energy Research and Development Administration, Albuquerque, N. Mex.
SOLAR TOTAL ENERGY SYSTEM: LARGE SCALE EXPERIMENT, SHENANDOAH, GEORGIA. VOLUME 1. SECTION 1: CONCLUSIONS AND RECOMMENDATIONS. SECTION 2: SYSTEMS REQUIREMENTS
17 Oct. 1977 153 p
(Contract EG-77-C-04-3987)
(ALO/3987-1/1-Vol-1) Avail: NTIS HC A08/MF A01

Baseline design recommendations, facility requirements, solar system, schedules and costs are described for a large scale solar total energy experiment designed to provide both thermal and electrical power to a knitwear factory employing 300 people. The systems requirements analysis covers loads, energy displacement, local laws and ordinances, life cycle costs, health and safety, environmental and reliability assessments, and utility interface. ERA

N78-25645# California Univ., Livermore. Lawrence Livermore Lab.
MECHANICAL ENGINEERING DEPARTMENT Quarterly Report, Jul. - Sep. 1977
R. G. Stone, ed., M. B. Bathgate, ed., D. N. Cornish, D. W. Deis, A. R. Harvey, D. G. Hirzedl, J. E. Johnston, R. L. Leber, R. L. Nelson, J. P. Zbasnik et al 30 Sep. 1977 34 p refs
(Contract W-7405-eng-48)
(UCRL-50016-77-3) Avail: NTIS HC A03/MF A01

The initial efforts were directed toward developing optical and heat transfer codes to model the inflated cylindrical concentrator performances. These codes gave detailed information on how geometry, optical and thermal properties, and ambient conditions affect collector performance. It was found that surface properties of the receiver tube are critical. The annular gap size between the receiver tube and the surrounding plastic jacket was investigated. Results indicate that manually reorienting the collector tilt once a week in the north-south plane gives 90% of the obtainable by active tracking in the north-south plane each day. ERA

N78-25646# California Univ., Berkeley. Lawrence Berkeley Lab.
ANAEROBIC FERMENTATION OF SIMULATED IN-SITU OIL SHALE RETORT WATER
E. A. Ossio, J. P. Fox, J. F. Thomas, and R. E. Poulson (DOE, Laramie, Wyo.) Nov. 1977 13 p refs Presented at the Meeting of the Am. Chem. Soc., Anaheim, Calif., 22-23 Mar. 1978
(Contract W-7405-eng-48)
(LBL-6855; Conf-780305-6) Avail: NTIS HC A02/MF A01

The feasibility of removing soluble organics from oil shale retort water by anaerobic digestion with methane production was experimentally investigated. The following conclusions were made. The retort water studied had to be pretreated to remove toxic and add deficient constituents before it could be successfully treated with the anaerobic fermentation process. Pretreatment included pH adjustment to 7, ammonia reduction, and nutrient addition. A digested sludge from a conventional municipal sewage treatment plant was successfully acclimated to the retort water studied. A major fraction of the organics in the retort water studied was stabilized by conversion to CH4 and CO2 using the anaerobic fermentation process. ERA

N78-25647# Oak Ridge National Lab., Tenn. Chemical Technology Div
EVALUATION OF IN SITU COAL GASIFICATION PROCESSES ON A REGIONAL BASIS
W. C. Ulrich Dec. 1977 61 p refs
(Contract W-7405-eng-26)
(ORNL-5279) Avail: NTIS HC A04/MF A01

A comparison was made of four candidate in situ coal gasification processes on the basis of a qualitative assessment of their technical merits and their suitability for application to various resource types and configurations in the continental United States. Three seam thickness, two seam dips, and seam depths to 3000 ft were considered. The United States was divided into four regions, and a predominant or representative coal type was selected within each region for purpose of displaying each candidate process to its best advantage. Russian experience, where it applies to the regional conditions under consideration, is described. Current techniques for linking wells drilled into coal seams are either slow, erratic, and/or costly. Therefore, to reduce the time and expense of in situ gasification, it is necessary to develop reliable, rapid linking techniques for the different coal types, various resource configurations, and diverse geological conditions. Author

N78-25648# Combustion Engineering, Inc., Windsor, Conn. Power Systems Group.
SAMPLING AND ANALYSIS REQUIREMENTS FOR LOW-BTU GASIFICATION OF COAL FOR ELECTRIC POWER GENERATION Final Report, Feb. 1975 - Aug. 1976
David M. Farrell Apr. 1977 142 p refs
(Contract EX-76-C-01-1545)
(FE-1545-38) Avail: NTIS HC A07/MF A01

Process analytical instrumentation requirements were identified for a 5 ton per hour, low Btu, atmospheric pressure, entrained bed, coal gasification process development unit (PDU). Special process instruments (primarily used for gas analysis and not usually encountered in boiler design applications) which are needed to satisfy measurement requirements were selected from instrument operating characteristics/features to provide reliable and straightforward measurement. Both in situ and extractive type instruments were selected for purchase. The necessary extractive sampling network was defined. Application of the instruments selected for the PDU to a commercial scale gasification plant was examined. It was concluded that with only few modifications, the same of similar instruments used on the PDU, can be used on commercial scale plants. ERA

N78-25649# Dow Chemical Co., Midland, Mich. Hydrocarbons and Energy Research Dept
ENERGY FROM IN SITU PROCESSING OF ANTRIM OIL SHALE Quarterly Technical Progress Report, Jul. - Sep. 1977
J. P. Humphrey 18 Oct. 1977 39 p
(Contract EX-76-C-01-2346)
(FE-2346-16; DOW/SRPR-16) Avail: NTIS HC A03/MF A01

The first in situ extraction trial has been completed using an electrical heater to initiate combustion. Evidence of oxidation was obtained by analysis of gases from the production well. An attempt to induce horizontal fractures, was halted when vertical fractures were induced by the pressure applied to seal off a zone with a packer. Shale characterization work and resource inventory activity are well underway. ERA

N78-25650# Energy Research and Development Administration, Pittsburgh, Pa. Energy Research Center.
RESEARCH IN COAL-BASED MAGNETOHYDRODYNAMICS Quarterly Technical Progress Report, Apr. - Jun. 1977
D. Bienstock 1977 20 p refs
(TID-27893) Avail: NTIS HC A02/MF A01

Runs were made in the nominal 5 megawatt pressurized MHD coal gasifier-combustor pilot plant including the first operation on coal. Several facility system improvements were made as a result of the first coal run. Testing of a scroll-type cyclone combustor was completed. Three additional tests using pittsburg seam coal were conducted with the original side-entry cyclone combustor. A third cyclone configuration, featuring top entry of fuel and air, was installed in the atmospheric pressure facility. Work was completed on a technical and economic evaluation of the PERC scheme for sulfur elimination from coal-fired MHD power plant. Program SCOOP (Staged Combustor Operation Optimizer Program) was run in routine support for about five computer hours. Implementation of the numerically stable linear programming code analyzes coals for enthalpy of

formation in routine SCOOP runs. A cyclone combustor code was reviewed and coupled to a multiphase equilibrium code BUSTION. ERA

N78-25651# Argonne National Lab., Ill.
EXPERIMENTAL TWO-PHASE LIQUID-METAL MAGNETOHYDRODYNAMIC GENERATOR PROGRAM Annual Report, Aug. 1975 - Sep. 1976
M. Petrick, G. Fabris, E. S. Pierson, D. A. Carl, A. K. Fischer, and C. E. Johnson Sep. 1977 101 p refs
(Contract W-31-109-eng-38)
(ANL-MHD-77-3) Avail: NTIS HC A06/MF A01

The revised ambient-temperature NaK-nitrogen facility is described. The maximum liquid flow rate and generator inlet pressure are 10.9 kg/s 200 gpm) and 1.48 MP/sub a/ absolute (200 psig), respectively, compared with the previous values of 6kg/s (110 gpm) and 0.72 MPa absolute (90 psig). Satisfactory loop operation was obtained, and new experiments with the second diverging-channel generator were completed. The principal experimental results were a higher power density for the same generator operating conditions, and an apparent tendency for the efficiency to improve more with increasing quality at higher velocities than lower velocities. An evaluation of an annular generator geometry is presented. The advantages and disadvantages of the geometry are described, the equations developed, and solutions obtained for three cases-constant velocity and no armature reactions, laminar flow with no armature reaction, and armature reaction with constant velocity. ERA

N78-25652# Dow Chemical Co., Midland, Mich. Hydrocarbons and Energy Research Dept.
ENERGY FROM IN SITU PROCESSING OF ANTRIM OIL SHALE Monthly Technical Progress Report, Nov. 1977
John P. Humphrey 19 Dec. 1977 14 p
(Contract EX-76-C-01-2346)
(FE-2346-19; DOW/SRPR-19) Avail: NTIS HC A02/MF A01

Reported are in situ fracturing and assessment, in situ extraction trials; shale characterization and resource evaluating; and environmental, public policy, and legal assessment. ERA

N78-25653# Sandia Labs., Albuquerque, N. Mex.
OIL SHALE PROGRAMS Quarterly Report, Apr. - Jun. 1977
R. R. Boade, ed. Oct. 1977 64 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1497; QR-6) Avail: NTIS HC A04/MF A01

The operating characteristics of an oxygen probe (to monitor oxygen concentration in the effluent gases of a retort) were enhanced by improvements in the sensing electrodes and seals of the unit. Three hydrofractures were formed for the rubblization experiment scheduled for later this year. The dependence of the fracture properties of oil shale on rate of deformation was examined through an analysis in which theoretical predictions were compared with experimental observations. Author

N78-25654# Physics International Co., San Leandro, Calif.
INVERSE DIODE STUDY Final Report
Sep. 1977 34 p refs
(Contract EY-76-C-03-1278)
(PIFR-959) Avail: NTIS HC A03/MF A01

The experimental work and resultant data of an inverse diode study program are reported. The thrust of the effort is demonstration of an inverse diode concept, at greater than 100 kA pulsed current and 10 to the 9th power W/sq cm energy density levels, for conversion of relativistic electron beam energy into useful electromagnetic energy. The experiments show that the entire injected electron current can be utilized by the inverse diode and more than 70 percent of the injected beam energy can be extracted to supply a secondary diode of matched impedance. An implication of these findings is that design of a vacuum current function, in which multiple beams can be combined to produce beyond state-of-the-art power and current levels in a secondary load, is feasible. A theoretical calculation of electron scattering through thin foils is appended. ERA

N78-25655# New England Federal Regional Council. Energy Resource Development Task Force.
POTENTIAL OF WOOD AS AN ENERGY RESOURCE IN NEW ENGLAND
Joseph M. Pecoraro, Robert Chase, Peter Fairbank, and Richard Meister Sep. 1977 100 p refs
(TID-28131) Avail: NTIS HC A05/MF A01

Topics discussed include: the benefits of utilizing the forest as an energy resource; the availability of commercial forest land; the harvesting and transportation of timber for wood energy projects; and institutional problems associated with developing the forest as an energy resource in New England. ERA

N78-25656# Sandia Labs., Albuquerque, N. Mex.
ECONOMIC MODEL OF A RELATIVISTIC ELECTRON BEAM HYBRID REACTOR
1977 7 p refs Presented at ANS winter meeting, San Francisco, 27 Nov. 1977
(Contract EY-76-C-04-0789)
(SAND-77-1097; Conf-771109-24) Avail: NTIS HC A02/MF A01

An optimization model of the economics of power generation using a relativistic electron beam hybrid reactor is briefly discussed. An assumed model structure is described. Projected plant costs vs. plant output are discussed. An optimization procedure is used to determine the lowest power and fissile fuel prices associated with a given model reactor concept. The levelized busbar energy cost is projected to be 30 m cents/kWh using the model. ERA

N78-25657# National Technical Information Service, Springfield, Va.
TOTAL ENERGY SYSTEMS FOR BUILDINGS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1964 - Mar. 1978
Audrey S. Hundemann, ed. Mar. 1978 74 p Supersedes NTIS/PS-77/0273; NTIS/PS-76/0275
(NTIS/PS-78/0306; NTIS/PS-77/0273; NTIS/PS-76/0275)
Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 10B

Technology and economics associated with total energy systems are discussed in these Federally-funded research citations. These systems employ a primary source of energy, such as oil, natural gas, or solar heat to provide comprehensive energy requirements in the form of light, heating, cooling, air conditioning, drying, process heat, and power for an industrial plant or for a commercial or public building. Included are schemes for electricity generation, waste heat recovery, and direct drive of mechanical equipment coupled to a prime mover. Abstracts primarily pertain to Modular Integrated Utility Systems (MIUS) technology as applied to residential complexes; a few abstracts deal with MIUS technology for military facilities and commercial buildings. Topic areas cover social costs, energy conservation potential, and the use of solar energy in total energy systems. GRA

N78-25658# National Technical Information Service, Springfield, Va.
TOTAL ENERGY SYSTEMS FOR BUILDINGS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1978
Audrey S. Hundemann, ed. Mar. 1978 157 p Supersedes NTIS/PS-77-0272; NTIS/PS-76/0274
(NTIS/PS-78/0305; NTIS/PS-77/0272; NTIS/PS-76/0274)
Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 10B

For abstract, see N78-25657.

N78-25659# National Technical Information Service, Springfield, Va.
PETROLEUM RECOVERY. VOLUME 2: RESERVOIR ENGINEERING AND RECOVERY METHODS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1976 - Mar. 1977
Audrey S. Hundemann Mar. 1978 184 p
(NTIS/PS-78/0278) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 08G

Thermal recovery methods and well stimulation using waterflooding, steam injection, gas injection, and fluid injection techniques are discussed. Topic areas cover fire flooding, caustic water flooding, miscible displacement, microemulsion flooding, polymer flooding, carbon dioxide miscible flooding, control of water mobility using polymers, and heat loss calculations. Reservoir modeling and simulation studies and studies pertaining to well

logging, core analysis, and well perforation are included. A few abstracts discuss techniques of determining residual oil saturation, predicting oil recoverability, and monitoring the degree of flooding. (This updated bibliography contains 177 abstracts, none of which are new entries to the previous edition.) GRA

N78-25660# National Technical Information Service, Springfield, Va.
PETROLEUM RECOVERY. VOLUME 3: RESERVOIR ENGINEERING AND RECOVERY METHODS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Apr. 1977 - Feb. 1978
Audrey S. Hundemann Mar. 1978 218 p Supersedes NTIS/PS-77/0233
(NTIS/PS-78/0279; NTIS/PS-77/0233) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 08G
For abstract, see N78-25659.

N78-25661# National Technical Information Service, Springfield, Va.
WASTE HEAT UTILIZATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1978
Audrey S. Hundemann Mar. 1978 258 p Supersedes NTIS/PS-77/0283; NTIS/PS-76/0276; NTIS/PS-75/215; COM-74-11138; COM-73-11582
(NTIS/PS-78/0294; NTIS/PS-77/0283; NTIS/PS-76/0276; NTIS/PS-75/215; COM-74-11138; COM-73-11582) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 10A
Federally-funded research on techniques of recovering waste heat from power plants, buildings, industrial processes, and waste disposal is covered. Studies of waste heat boilers and the use of waste heat for irrigation, sewage treatment, odor control, desalination, heating, and aquaculture are included. GRA

N78-25662# National Technical Information Service, Springfield, Va.
WASTE HEAT UTILIZATION, VOLUME 3. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1977 - Mar. 1978
Audrey S. Hundemann Mar. 1978 160 p Supersedes NTIS/PS-77/0284; NTIS/PS-76/0278
(NTIS/PS-78/0296; NTIS/PS-77/0284; NTIS/PS-76-0278) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 10A
Worldwide research of waste heat from industrial process plants, electric power plants, buildings, and incineration of wastes is covered. Emphasis is on energy conservation in industrial plants. Studies of waste heat boilers and the use of waste heat for irrigation, sewage treatment, odor control, desalination, and heating are included. GRA

N78-25663# National Technical Information Service, Springfield, Va.
WASTE HEAT UTILIZATION, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1975-1976
Audrey S. Hundemann Mar. 1978 187 p
(NTIS/PS-78/0295) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 10A
For abstract, see N78-25662.

N78-25664# Purdue Univ., Lafayette, Ind. Agricultural Experiment Station.
CONSERVING ENERGY WITH NITRIFICATION INHIBITORS: ENERGY IN AGRICULTURE
D. W. Nelson, L. E. Sommers, D. M. Huber, and H. L. Warren Jun. 1977 10 p refs
(Grant NSF AER-75-18726)
(PB-277199; NSF/RA-770243; Rept-6289) Avail: NTIS HC A02/MF A01 CSCL 10B
Field trials were conducted to evaluate the effectiveness of two nitrification inhibitors (nitrapyren and terrazole) in improving the efficiency of N fertilizer utilization by corn and wheat. There were significantly increased grain protein content and protein yield of corn and wheat. Increased efficiency in crop growth resulting from inhibiting nitrification may allow production of the same amount of grain on 5 percent smaller area with a fuel savings of 1.09 x 10 to the 12th power calories. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N78-25665# National Inst. of Environmental Health Sciences, Research Triangle Park, N. C.
THE ATMOSPHERE: ENDANGERED AND ENDANGERING
William W. Kellogg, ed., Margaret Mead, ed., Anthony Broderick, Richard S. Greeley, J. Dana Thompson, and Barbara West Sep. 1976 157 p refs Proc. held at Research Triangle Park, N. C.; sponsored in part by the Fogarty (John E.) Intern. Center for Advan. Study in the Health Sci.
(FIC-39; DHEW/Publ/NIH-77-1065) Avail: NTIS MF A01; HC SOD
Presentations are concerned with the interactions of society and the atmospheric environment, and the global and regional effects thereof. Topics covered include: man's influence on stratospheric ozone, theories of global climatic change, climatic variability and its effect on food production, aerospace control, and technology and the atmosphere. M.V.

N78-25666# Environmental Protection Agency, Washington, D. C. Standing Work Group on Water Monitoring.
BASIC WATER MONITORING PROGRAM
2 May 1978 56 p refs Revised
(EPA-440/9-76-025-Rev) Avail: NTIS HC A04/MF A01
A water monitoring program was designed to stabilize State programs, by clearly stating what is expected of EPA and the states: to improve the effectiveness of state and EPA programs and reduce duplication of effort; to ensure that fundamental data needs are met; and make the best use of existing resources and technology. The basic program document is intended to serve as monitoring guidelines under the Section 106 Appendix A regulations and will be implemented through the FY78 State and Regional program guidance. The guidelines aim to: (1) redirect ambient and effluent monitoring at the state level from a fixed-station, single discharge approach to an intensive survey approach; (2) identify dischargers to the states' waters and assess their water quality impact; (3) define a minimum number of fixed ambient stations that are to be operated at the state level, within a consistent framework; (4) provide a coordinated nationwide assessment of selected toxic pollutants; and (5) ensure that data which are collected are used in the decision-making process and to educate the public and inform the Congress.
Author

N78-25667# Beckman Instruments, Inc., Anaheim, Calif.
CHEMILUMINESCENT MONITOR FOR VINYL CHLORIDE Final Report, Mar. 1975 - Jun. 1976
S. G. Riccio, M. W. Greene, W. D. Dencker, and R. I. Wilson Feb. 1978 53 p
(Contract EPA-68-02-1770)
(PB-277391; EPA-600/2-78-008) Avail: NTIS HC A04/MF A01 CSCL 13B
A monitor for vinyl chloride monomer (VCM) in ambient air was constructed using commercially available components of a gas chromatograph (GC) coupled with a chemiluminescence ozone analyzer slightly modified to make it suitable for use as a GC detector. The specificity for VCM was enhanced by use of a chemiluminescence detector because saturated hydrocarbons did not chemiluminesce with ozone. Test results indicated that a monitor of this type can detect less than one part per billion of VCM in ambient air operating on a 15 minute cycle. GRA

N78-25668# Hawaii Univ., Honolulu.
EIS HANDBOOK: A GUIDE TO HAWAII'S REQUIREMENTS AND PROCESS
Raymond S. Tabata Dec. 1977 21 p Sponsored by NOAA, Wash., D. C.
(PB-278289; NOAA-78020318) Avail: NTIS HC A02/MF A01 CSCL 13B
The Hawaii, EIS' are written for federal, state, county, and private projects. Although there are different laws which require EIS's for projects in Hawaii, this handbook focuses on the state law--Act 246 of 1974. Appendix A briefly discusses EIS's required

by other laws such as the National Environmental Policy Act of 1969 (also known as NEPA). Author

N78-25669# National Oceanic and Atmospheric Administration, Silver Spring, Md.
FISCAL YEAR 1976 SUMMARY REPORT OF NOAA METEOROLOGY LABORATORY SUPPORT TO THE ENVIRONMENTAL PROTECTION AGENCY
Viebrock, ed. (Meteorology Lab., Res. Tri. Park, N.C.) Jul. 1977 171 p refs
(PB-278302; NOAA-TM-ERL-ARL-67) Avail: NTIS HC A08/MF A01 CSCL 13B

Research and operational support covers the meteorological aspects of environmental impact statements, implementation plans, and grant and contract proposals; the application of dispersion models; and conduct of dispersion studies and evaluations. Research support was in the areas of model development and application, and climatic analysis. Dispersion models for inert and reactive pollutants on all temporal and spatial scales continued under development and evaluation. Work was begun on long-distance dispersion model development. Boundary layer meteorological field experiments leading to the development of boundary layer models were conducted. Experiments on neutral atmospheres in the wind tunnel and dispersion in stratified atmospheres using the newly completed water channel/towing tank are also outlined. The 25 station observing network in the St. Louis metropolitan area was in full operation as part of the Regional Air Pollution Study. GRA

N78-25670# Brigham Young Univ., Provo, Utah.
BREEDING AND SELECTION OF PLANT MATERIALS FOR REHABILITATION OF MINE SPOILS Progress Report
Howard C. Stutz Apr. 1977 15 p refs Prepared in cooperation with Argonne Natl. Lab., Ill.
(Contract W-31-109-eng-38)
(ANL-LRP-77-1) Avail: NTIS HC A02/MF A01

Utah International's Navajo Mine was selected as a research site for the development of plants suitable for rehabilitating mined land. Because the disturbed areas at the Navajo Mine are mostly heavy saline clays, the plants most likely to be immediately successful under the regime of hot summer, cold winters, and sporadic, low precipitation are members of the family Chenopodiaceae and particular species of grasses. The plants which are being used, are Atriplex and grasses from the tribe Hordeae. The growth of containerized and seed-sown plants following irrigation only, irrigation plus fertilizer only, or unamended were studied. Preliminary data on population dynamics and hybridization are reported. Author

N78-25671# New Hampshire Univ., Durham.
INVESTIGATION OF THE MECHANISM OF FLY-ASH FORMATION IN COAL-FIRED UTILITY BOILERS Quarterly Report, 1 May 1977 - 31 Jul. 1977
G. D. Ulrich 24 Aug. 1977 10 p refs
(Contract EX-76-C-01-2205)
(FE-2205-8) Avail: NTIS HC A02/MF A01

A probe was developed and chemical analysis techniques were established for quantitative fly-ash analysis. The program for computing condensed-phase equilibria is ready for use in a theoretical analysis. A model for submicron fly-ash formation and growth was developed. ERA

N78-25672# Meteorology Research, Inc., Altadena, Calif.
AIRBORNE MONITORING OF COOLING TOWER EFFLUENTS. VOLUME 1: TECHNICAL SUMMARY Final Report
G. J. Woffinden, P. R. Harrison, and J. A. Anderson Jun. 1977 117 p refs
(EPRI-EA-420) Avail: NTIS HC A02/MF A01

Plume measurement included temperature, dew point, visibility, turbulence, droplet size distribution and concentration, liquid water content, sodium chloride concentration, sulfuric acid concentration, and sulfur dioxide concentration. Vertical cross sections of the plume were mapped and data were recorded every half second to provide the short response times required for accurate plume profile measurements. The presence of stable visible plumes was observed during cold high humidity conditions. ERA

N78-25673# Oak Ridge National Lab., Tenn.
VALIDATION OF THE KINETIC MODEL FOR PREDICTING THE COMPOSITION OF CHLORINATED WATER DISCHARGED FROM POWER PLANT COOLING SYSTEMS
M. H. Lietzke 31 Oct. 1977 18 p refs
(Contract W-7405-eng-26)
(ORNL/NUREG-32) Avail: NTIS HC A02/MF A01

The model as formulated takes into account the forward and reverse rates of chemical reactions leading to the formation of monochloramine, dichloramine, and organic chloramine (modeled by methyl chloramine). In addition to these three equations, the model also includes a differential equation for the irreversible uptake of chlorine in satisfying the chlorine demand of the water. Input to the computer program consists of the operating characteristics of the cooling system and the chemical composition of the water (amounts of inorganic and organic nitrogen, chlorine demand, pH, and temperature). Output consists of the amounts of the chloramines and total residual chlorine in the discharge water as a function of time. Author

N78-25674# Radian Corp., Austin, Tex.
ASSESSMENT, SELECTION, AND DEVELOPMENT OF PROCEDURES FOR DETERMINING THE ENVIRONMENTAL ACCEPTABILITY OF SYNTHETIC FUEL PLANTS BASED ON COAL, APPENDIX 2
R. G. Oldham and R. G. Wetherold May 1977 495 p refs Revised
(Contract EX-76-C-01-1795; Contract E(49-18)-1795)
(FF-1795-3-Pt-2-Rev) Avail: NTIS HC A21/MF A01

Process engineering analyses were conducted on five processes considered representative of the emerging technologies: Koppers-Totzek, Lurgi, Solvent Refined Coal, Synthane, and Synthoil. A detailed analysis was performed on a generalized coal handling facility which was common to all of the above processes. The process engineering analyses were conducted from a mass and energy balance orientation. All process streams, including effluent streams, were fully characterized as to temperature, pressure, phase, bulk composition and flow rate. Possible paths of pollutants were followed through the selected processes. All gaseous, liquid and solid effluents were identified, with special emphasis being placed on the EPA criteria pollutants and trace organics and inorganics contained in these streams. A sampling approach generally applicable to all coal conversion processes was developed. ERA

N78-25675# Battelle Pacific Northwest Labs., Richland, Wash.
PROCESS FOR CLEANING AND REMOVAL OF SULFUR COMPOUNDS FROM LOW Btu GASES Quarterly Summary Report, Jul. - Sep. 1977
R. H. Moore, D. G. Ham, D. H. Mitchell, R. J. Robertus, and G. E. Stegen Oct. 1977 18 p
(Contract EY-76-C-06-1830)
(BNWL-2040-7) Avail: NTIS HC A02/MF A01

The Process Development Unit (PDU) is being remodeled by incorporation of appropriate subsystems to permit operation in continuous process mode. The PDU will be operated for a period of time sufficient to demonstrate process viability. A major part of the electrical work including assembly of relay and circuit breaker enclosures, installation of screwcover wireway, and installation of large transformers was completed. Installation of thermocouples and electrical heating elements is completed and final wiring is nearly complete. Installation of high-temperature insulation (Kaowool) and a final waterproof outer covering is 90% complete. Test operation of individual equipment items is proceeding as rapidly as these become operational. ERA

N78-25676# Federal Energy Administration, Washington, D. C.
CAPLINE GROUP SALT DOMES. DRAFT ENVIRONMENTAL IMPACT STATEMENT. VOLUME 1: BAYOU CHOCTAW EXPANSION, CHACAHOULA, IBERIA, NAPOLEONVILLE, WEEKS ISLAND EXPANSION
Sep. 1977 408 p
(FEA/S-77/339; DES-77-9-Vol-1) Avail: NTIS HC A18/MF A01

This environmental impact statement for the Capline Group in Louisiana is in three volumes. This volume contains the text of the environment, and of the project's probable impacts. Mitigative measures and unavoidable adverse impacts are

reviewed. The relationship between local short-term uses of the environment and long-term productivity is discussed. Those commitments of resources which are irreversible and irretrievable are also discussed. Proposed and alternative actions are summarized, and the agencies contacted and the various permits and licenses required are listed. ERA

N78-25677# Oak Ridge National Lab., Tenn.
FUNCTIONAL COMPLEXITY AND ECOSYSTEM STABILITY: AN EXPERIMENTAL APPROACH Ph.D. Thesis - Tennessee Univ.
P. VanVoris, R. V. Oneill, H. H. Schugart, and W. R. Emanuel Jan. 1978 133 p refs
(Contract W-7405-eng-26)
(ORNL-TM-6199) Avail: NTIS HC A07/MF A01

The complexity-stability hypothesis was experimentally tested using intact terrestrial microcosms. Functional complexity was defined as the number and significance of component interactions (i.e., population interactions, physical-chemical reactions, biological turnover rates) influenced by nonlinearities, feedbacks, and time delays. It was postulated that functional complexity could be nondestructively measured through analysis of a signal generated from the system. Power spectral analysis of hourly CO2 efflux was analyzed for the number of low frequency peaks and used to rank the functional complexity of each system. Ranking of ecosystem stability was based on the capacity of the system to retain essential nutrients and was measured by net loss of Ca after the system was stressed. Rank correlation supported the hypothesis that increasing ecosystem functional complexity leads to increasing ecosystem stability. ERA

N78-25678# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.
ENERGY/ENVIRONMENT 2. PROCEEDING OF 2ND NATIONAL CONFERENCE ON THE INTERAGENCY R AND D PROGRAM
Richard Laska, ed. and Kathleen Dixon, ed. Nov. 1977 515 p refs Proc. held at Washington, D. C., 6-7 Jun. 1977
(Contract EPA-68-01-2934)
(PB-277917; EPA-600/9-77-025) Avail: NTIS HC A22/MF A01 CSCL 13B

The proceedings from the Second National Conference on the Interagency Energy/Environment R&D Program are reported. All papers presented at the conference along with discussion from question and answer periods are included in the text. This volume is part of the Energy/Environment R&D Decision Series. The series presents the key issues and findings of the Federal Interagency Energy/Environment Research and Development Program in a format conducive to efficient information transfer. Planned and coordinated by the Environmental Protection Agency (EPA), research projects supported by the program range from the analysis of health and environmental effects of energy systems to the development of environmental control technologies. The works in this series reflect the full range of program concerns. GRA

N78-25679# NATO Committee on the Challenges of Modern Society, Brussels (Belgium).
AIR POLLUTION ASSESSMENT METHODOLOGY AND MODELING. BIBLIOGRAPHY OF GREY LITERATURE ON AIR QUALITY MODELING
Oct. 1977 186 p
(PB-277442; NATO/CCMS-70) Avail: NTIS HC A09/MF A01 CSCL 13B

From the results of the NATO/CCMS Pilot Study Air Pollution fifteen recommendations have been derived, one of which deals with air quality modeling. A world-wide cooperation in the field of modeling activities has proved the necessity to review the state of the art of air quality modeling and to show international trends in model standardization. Therefore, the Modeling Panel decided to prepare a Technical Document of this so-called 'Grey Literature' and started questionnaire action. Response was so impressive, that the modeling panel decided to split this document into two parts: (1) Bibliography of Grey Literature on Applied Air Quality Models (especially Gaussian Plume Models); and (2) Bibliography of Grey Literature on New Modeling Techniques. This volume represents the final version of the part concerning Gaussian plume models. GRA

N78-25680# National Technical Information Service, Springfield, Va.
GAS SCRUBBERS USED IN POLLUTION CONTROL, VOLUME 4. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1977 - Mar. 1978
Diane M. Cavagnaro Mar. 1978 155 p Supersedes NTIS/PS-77/0193; NTIS/PS-76/0052
(NTIS/PS-78/0256; NTIS/PS-77/0193; NTIS/PS-76/0052) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

The citations include design, performance, gas flow characteristics, and the chemistry of the pollutants. The pollution control SO2, NOx, CO, CO2, as well as hydrocarbons and particles is discussed. GRA

N78-25681# National Technical Information Service, Springfield, Va.
GAS SCRUBBERS USED IN POLLUTION CONTROL VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Mar. 1978
Diane M. Cavagnaro Mar. 1978 187 p Supersedes NTIS/PS-77/0190; NTIS/PS-76/0050
(NTIS/PS-78/0254; NTIS/PS-77/0190; NTIS/PS-76/0050) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Processes and equipment used in the removal of SO2, NOx, CO, CO2, organic compounds and particulates are described. Design, performance, chemistry, and some of the gas flow characteristics for both stationary as well as mobile sources were included. GRA

N78-25682# National Technical Information Service, Springfield, Va.
GAS SCRUBBERS USED IN POLLUTION CONTROL, VOLUME 3. CITATIONS FROM THE ENGINEERING INDEX DATA BASE
Diane M. Cavagnaro Mar. 1978 139 p
(NTIS/PS-78/0255) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

The bibliography contains worldwide citations on particle and gas scrubbers. They discuss the pollution control of SO2, NOx, CO, CO2, as well as hydrocarbons and particles. Design, performance, gas flow characteristics, and the chemistry of the pollutants are included. Author

N78-25683# National Technical Information Service, Springfield, Va.
AIR POLLUTION EFFECTS ON PLANTS, VOLUME 1: A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Mar. 1976
Pernell W. Crockett, ed. Mar. 1978 178 p
(NTIS/PS-78/0230) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

The bibliography presents a compilation of abstracts which deal with the effects of combustion products, industrial and automotive emissions on vegetation, forestry, and agricultural crops. Studies are also included relative to sink and emission factors for air pollutants. (This updated bibliography contains 173 abstracts, none of which are new entries to the previous edition.) GRA

N78-25684# National Technical Information Service, Springfield, Va.
AIR POLLUTION EFFECTS ON PLANTS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Apr. 1976 - Mar. 1978
Pernell W. Crockett, ed. Mar. 1978 78 p Supersedes NTIS/PS-77/0205; NTIS/PS-76/0015 and NTIS/PS-75/101
(NTIS/PS-78/0231; NTIS/PS-75/0205; NTIS/PS-76/0015; NTIS/PS-75/101) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

The bibliography presents a compilation of abstracts which deal with the effects of combustion products, industrial and automotive emissions on vegetation, forestry, and agricultural crops. Studies are also included relative to sink and emission factors for air pollutants. (This updated bibliography contains 73 abstracts, 24 of which are new entries to the previous edition.) GRA

N78-25685# National Technical Information Service, Springfield, Va.
ECOLOGY OF THE MARINE ENVIRONMENT, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Apr. 1976 - Mar. 1977
Elizabeth A. Harrison Mar. 1978 186 p
(NTIS/PS-78/0274) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

The selected abstracts of research reports cover salt water ecology of shellfish, fishes, aquatic plants, aquatic animals, and aquatic microorganisms. Estuary studies are included as are pollution effects, except for reports dealing with pesticides and oil pollution. Author

N78-25686# National Technical Information Service, Springfield, Va.
ECOLOGY OF THE MARINE ENVIRONMENT, VOLUME 4. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Apr. 1977 - Mar. 1978
Elizabeth A. Harrison Mar. 1978 188 p Supersedes NTIS/PS-77/0215; NTIS/PS-76/0239; NTIS/PS-75/329
(NTIS/PS-78/0275; NTIS/PS-77/0215; NTIS/PS-76/0239; NTIS/PS-75/329) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

The selected abstracts of research reports cover salt water ecology of shellfish, fishes, aquatic plants, aquatic animals, and aquatic microorganisms. Estuary studies are included as are pollution effects, except for reports dealing with pesticides and oil pollution. Author

N78-25687# California Inst. of Tech., Pasadena. Div. of Chemistry and Chemical Engineering.
ATMOSPHERIC TRACER STUDIES TO CHARACTERIZE THE TRANSPORT AND DISPERSION OF POLLUTANTS IN THE CALIFORNIA DELTA REGION: EXECUTIVE SUMMARY Final Report
Brian K. Lamb and Fredrick H. Shair Jun. 1977 78 p refs (Grant ARB-A5-065-87)
(PB-277732; ARB-R-A5-065-87-77-68) Avail: NTIS HC A05/MF A01 CSCL 13B

Tracer studies were conducted to quantitatively determine the transport and dispersion characteristics of the air passing over a proposed industrial site in the Montezuma Hills. On the average, plumes were transported southeast. Estimates of tracer concentrations based upon the Gaussian plume model were found to be reasonably accurate. A nomograph was developed to permit rapid calculation of nonreactive pollutant concentrations from tracer data and pollutant emission rates. The nomograph was used to predict ground level concentrations of pollutants resulting from the projected emissions. A reasonable correlation was found to exist between the horizontal standard deviation of the wind sigma y and the horizontal dispersion parameter of the plume, sigma y. GRA

N78-25688# California Inst. of Tech., Pasadena. Div. of Chemistry and Chemical Engineering.
ATMOSPHERIC TRACER STUDIES TO CHARACTERIZE THE TRANSPORT AND DISPERSION OF POLLUTANTS IN THE CALIFORNIA DELTA REGION. VOLUME 1: PRESENTATION AND DISCUSSION OF RESULTS Final Report
Brian K. Lamb and Fredrick H. Shair Jun. 1977 284 p refs (Grant ARB-A5-065-87)
(PB-277733; ARB-R-A5-065-87-77-69-Vol-1) Avail: NTIS HC A13/MF A01 CSCL 13B
For abstract, see N78-25687.

N78-25689# California Inst. of Tech., Pasadena. Div. of Chemistry and Chemical Engineering.
ATMOSPHERIC TRACER STUDIES TO CHARACTERIZE THE TRANSPORT AND DISPERSION OF POLLUTANTS IN THE CALIFORNIA DELTA REGION. VOLUME 2, PART A: PRESENTATION OF TRACER AND METEOROLOGICAL DATA Final Report
Brian K. Lamb, Martin Derus, and Fredrick H. Shair Jun. 1977 280 p refs
(Grant ARB-A5-065-87)
(PB-277734; ARB-R-A5-065-87-77-70-Vol-2) Avail: NTIS HC A13/MF A01 CSCL 13B
For abstract, see N78-25687.

N78-25690# California Inst. of Tech., Pasadena. Div. of Chemistry and Chemical Engineering.
ATMOSPHERIC TRACER STUDIES TO CHARACTERIZE THE TRANSPORT AND DISPERSION OF POLLUTANTS IN THE CALIFORNIA DELTA REGIONS. VOLUME 2, PART B: TABULATION OF TRACER AND METEOROLOGICAL DATA
Brian K. Lamb, Martin Derus, and Fredrick H. Shair Jun. 1977 337 p refs
(Grant ARB-A5-065-87)
(PB-277735; ARB-R-A5-065-87-77-71-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 13B
For abstract, see N78-25687.

N78-25691# New York State Dept. of Environmental Conservation, Albany.
INTERNATIONAL CONFERENCE ON OXIDANTS, 1976: ANALYSIS OF EVIDENCE AND VIEWPOINTS. PART 4: THE ISSUE OF NATURAL ORGANIC EMISSIONS Final Report
P. E. Coffey and H. Westberg Oct. 1977 55 p refs Prepared in cooperation with Washington State Univ., Pullman
(Contracts DA-7-2003H; DA-7-1290J)
(PB-277462; EPA-600/3-77-116-Pt-4) Avail: NTIS HC A04/MF A01 CSCL 13B

In recognition of the important and somewhat controversial nature of the oxidant control problem, the U.S. Environmental Protection Agency (EPA) organized and conducted a 5 day International Conference in September 1976. The more than one hundred presentations and discussions at the conference revealed the existence of several issues and prompted the EPA to sponsor a follow-up review/analysis effort. The follow-up effort was designed to review carefully and impartially, to analyze relevant evidence and viewpoints reported at the International Conference (and elsewhere), and to attempt to resolve some of the oxidant-related scientific issues. The review/analysis was conducted by experts (who did not work for the EPA or for industry) of widely recognized competence and experience in the area of photochemical pollution occurrence and control. GRA

N78-25692# Transportation Systems Center, Cambridge, Mass.
WORKSHOPS ON TRANSPORTATION-AIR QUALITY RESEARCH NEEDS FOR STATE, REGIONAL, AND LOCAL GOVERNMENT OFFICIALS Final Report, Apr. - Jul. 1977
Dec. 1977 111 p refs
(PB-277802; DOT-TSC-OST-77-69) Avail: NTIS HC A06/MF A01 CSCL 13B

The requirements for a research and development program on transportation-air quality research needs are identified. Based on the workshops, and the collected analysis of transportation-air quality practioners subsequent to the workshops, a report was prepared that first documents the ten most urgent transportation-air quality issues and then recommends sixteen research programs to address these issues. GRA

N78-25693# GCA Corp., Bedford, Mass. Technology Div.
INFORMATION DOCUMENT ON AUTOMOBILE EMISSIONS INSPECTION AND MAINTENANCE PROGRAMS Final Report
Benjamin Kincannon and Alan H. Castaline Jan. 1978 106 p refs
(Contract EPA-68-01-4458)
(PB-277776; GCA-TR-77-14-G(2); EPA-400/2-78-001) Avail: NTIS HC A06/MF A01 CSCL 13B

The processes, procedures, and methods to reduce or control motor vehicle emissions through inspection and maintenance programs are given. Subjects treated include: benefits and costs; alternative methods for implementing programs; legal and administrative considerations of inspection/maintenance; inspection/maintenance problem areas; and summaries of existing programs. GRA

N78-25694# National Technical Information Service, Springfield, Va.
COKE OVEN AIR AND WATER POLLUTION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress

Report, 1970 - Mar. 1978
Mona F. Smith Mar. 1978 177 p
(NTIS/PS-78/0297) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Monitoring, sampling, analyzing, transport properties, and control of emissions and effluents are cited in this compilation from worldwide journals. Pollutants described are sulfur dioxide, hydrogen sulfide, ammonia, phenols, benzopyrene, particulates and other trace elements and compounds. Process and equipment modification such as pipeline charging, wet and dry quenching, retrofitting, and oven leakage preventives are included. GRA

N78-25695# Environmental Sciences Research Lab., Research Triangle Park, N.C.
EVALUATION OF A SULFUR DIOXIDE MASS EMISSION RATE MONITORING SYSTEM Final Report, Aug. 1976 - Jul. 1977
Roosevelt Rollins Jan. 1978 38 p
(PB-277394; EPA-600/2-78-007) Avail: NTIS HC A03/MF A01 CSCL 13B

An evaluation was conducted to determine the capabilities and limitations of a commercially available monitoring system that provides sulfur dioxide mass emission rate data as a direct output. The monitoring system was operated continuously for extended periods at a coal-fired power plant and a sulfuric acid production facility. Additional testing was performed at a simulated stationary source facility to confirm some deficiencies noted during field operations. The system's performance was verified by comparing its output data with results using EPA emissions measurement reference methods. Results are presented for three performance tests at both field sites. For the power plant tests, the monitor agreed within 20% of the accepted reference method. In the case of the acid plant, the system accuracy was as poor at 58%. Generally, the monitoring system performed reliably throughout the extended tests program. The system remained operational greater than 90% of the time during the four month test period. GRA

N78-25696# Louisiana State Univ. and A&M Coll., Baton Rouge. Dept. of Chemistry.
PERSONAL MONITOR FOR NITROGEN DIOXIDE Final Report
P. West and Kenneth D. Reiszner Feb. 1978 34 p refs
(Grant EPA-R-803193-01)
(PB-277437; EPA-600/2-78-001) Avail: NTIS HC A03/MF A01 CSCL 13F

A personal monitor to measure nitrogen dioxide is discussed. Sampling of nitrogen dioxide is accomplished by permeation through a silicone membrane into a alkaline thymol blue solution. The nitrogen dioxide is converted to nitrite and is then quantitated by colorimetric analysis. Since collection of the nitrogen dioxide through the silicone membrane depends only on permeation, maintenance of carefully measured sampling rates is not required. A small scale field evaluation of this method with the accepted EPA-TGS-ANSA equivalent method for NO2 showed that the personal monitor gave much higher results. This difference must be resolved before this personal monitor can be considered as a viable equivalent method for nitrogen dioxide. GRA

N78-25697# Council on Environmental Quality, Washington, D.C.
CEQ PROJECTIONS OF OZONE AIR QUALITY
Kay H. Jones Feb. 1978 37 p refs
(PB-277625; Rept-11810278) Avail: NTIS HC A03/MF A01 CSCL 13B

A discussion of Council on Environmental Quality techniques for displaying air quality data, and for projecting future pollutant emissions is given. Author

N78-25698# Battelle Columbus Labs., Ohio.
SAMPLING AND ANALYTICAL METHODOLOGY FOR ATMOSPHERIC NITRATES: EVALUATION OF SAMPLING VARIABLES Interim Report
Chester W. Spicer and Phillip M. Schumacher Feb. 1978 44 p refs
(Contract EPA-68-02-2213)
(PB-277534; EPA-600/2-78-009) Avail: NTIS HC A03/MF A01 CSCL 13B

Experiments were carried out to determine the effect of nitrogen containing gases on a number of different filter materials. Gases studied include NO, NO2, N2O, HNO3, NH3, and PAN. Experiments were also conducted to determine the effect of sampling time and sampling rate on atmospheric nitrate collection. Studies of filter storage, and gas filtrate and gas soot interactions were also undertaken. In many cases serious interference with the collection of atmospheric nitrate was found. Author

N78-25699# Texas A&M Univ., College Station. Environmental Engineering Div.
ENVIRONMENTAL MANAGEMENT OF A SHIP CHANNEL-HARBOR COMPLEX
Marvin William Reavis and Roy W. Hann, Jr. Nov. 1977 148 p refs
(Grant SG-04-6-158-44012)
(PB-278145; TAMU-SG-78-202; NOAA-78022104) Avail: NTIS HC A07/MF A01 CSCL 13B

The environmental management of a typical ship channel harbor complex located along the Texas Gulf Coast is discussed. The long range environmental implications of the various activities are discussed so that management entities may make competent decisions in future planning that are conducive to an active industrial climate and a healthy environment. The study examined pollution sources and their impact upon the waterways. GRA

N78-25700# Environmental Sciences Research Lab., Research Triangle Park, N.C.
INTERNATIONAL CONFERENCE ON OXIDANTS; 1976, ANALYSIS OF EVIDENCE AND VIEWPOINTS. PART 8: THE ISSUE OF OPTIMUM OXIDANT CONTROL STRATEGY Final Report
W. Bonta (Dept. of Health and Mental Hygiene, Baltimore, Md.), J. Paisie (Dept. of Health and Mental Hygiene, Baltimore, Md.), P. Koziar (Dept. of Natural Resources, Madison, Wis.), B. Becker (Dept. of Natural Resources, Madison, Wis.), F. Sphuhler (Texas Air Control Board, Austin), K. Wald (Texas Air Control Board, Austin), L. Jager (Dept. of Natural Resources, Lansing, Mich.), and G. Wolff (Interstate Sanitation Commission, N. Y.) Dec. 1977 108 p refs Conf. held at Research Triangle Park, N. C., Sep. 1976
(Contracts DA-7-1934A; DA-7-2175A; DA-7-2044A; DA-7-2005H)
(PB-277626; EPA-600/3-77-120-Pt-8) Avail: NTIS HC A06/MF A01 CSCL 13B

In recognition of the oxidant control problem, the U.S. Environmental Protection Agency (EPA) organized and conducted a 5-day International Conference in September 1976. Presentations and discussions at the conference revealed the existence of several issues and prompted the EPA to sponsor a followup review/analysis effort. The followup effort was designed to review carefully and impartially, to analyze relevant evidence and viewpoints reported at the International Conference (and elsewhere), and to attempt to resolve some of the oxidant-related scientific issues. The review/analysis was conducted by experts of widely recognized competence and experience in the area of photochemical pollution occurrence and control GRA

N78-25701# National Technical Information Service, Springfield, Va.
POLLUTION AND ENVIRONMENTAL ASPECTS OF FUEL CONVERSION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Mar. 1978
Audrey S. Hundemann Apr. 1978 218 p Supersedes NTIS/PS-77/0212; NTIS/PS-76/0222 and NTIS/PS-75/371 (NTIS/PS-78/0314; NTIS/PS-77/0212; NTIS/PS-76/0222; NTIS/PS-75/371) Avail: NTIS HC $28.00/MF $28.00 CSCL 07A

Abstracts dealing with environmental impacts related to fossil fuel conversion processes (primarily coal gasification) are presented. A few citations concerning environmental considerations pertaining to future energy growth are included. GRA

N78-25702# New Mexico State Univ., University Park.
INFLUENCE OF ROAD SALTING ON THE NUTRIENT AND HEAVY METAL LEVELS IN STREAM WATER

James R. Gosz Dec. 1977 45 p refs Prepared in cooperation with New Mexico Univ., Albuquerque
(Contract DI-14-34-0001-7066)
(PB-278255/5; WRRI-093; W78-04708;
OWRT-A-057-NMEX(1)) Avail: NTIS HC A03/MF A01 CSCL 13B

The influence was evaluated of road salt on levels of nutrients, heavy metals, and sediment in streams as modified by topography. As a result of an extremely low snow pack, salt inputs and stream discharge were low. This reduced losses of nutrients and salt from the below road areas; however, the losses which did occur were strongly linked to the road salting practice. All study areas showed an accumulation of road salt because of the low discharge. The addition of massive quantities of sodium caused the release of other cations and significantly altered soil structure. The breakdown of soil structure appeared to be the major reason for large losses of sediment and heavy metals from the below road areas. Steep slopes and a large road area to below road area ratio appear most influential in altering water quality. GRA

N78-25476 World Meteorological Organization, Geneva (Switzerland).
AIR POLLUTION MONITORING AND THE WMO BACKGROUND AIR POLLUTION MONITORING NETWORK
G.W. Kronebach and R. E. Munn *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 31-41 (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

N78-25477 World Meteorological Organization, Geneva (Switzerland)
A SPECIAL ATMOSPHERIC POLLUTANT: THE PARTICULATE LOADING
E. Meszaros *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 42-52 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

N78-25478 World Meteorological Organization, Geneva (Switzerland).
SITING PROBLEMS FOR BACKGROUND AIR POLLUTION MONITORING STATIONS
A. Koehler *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 53-58 (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

N78-25479 World Meteorological Organization, Geneva (Switzerland).
ESTABLISHMENT OF BACKGROUND AIR POLLUTION MONITORING STATIONS AND PROBLEMS RELATED TO SAMPLING AND INSTRUMENTATION
A. Koehler *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 61-74 (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

N78-25481 World Meteorological Organization, Geneva (Switzerland).
AIR QUALITY MONITORING IN LATIN AMERICA AND THE CARIBBEAN
Ricardo Haddad *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 103-120 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

N78-25482 World Meteorological Organization, Geneva (Switzerland).
THE ROLE OF THE METEOROLOGIST IN THE AIR QUALITY MANAGEMENT PROCESS
James L. Dicke *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 123-145 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

N78-25484 World Meteorological Organization, Geneva (Switzerland).
METEOROLOGICAL ASPECTS OF LOCAL AND URBAN AIR POLLUTION WITH SPECIAL CONSIDERATION OF ENERGY PRODUCTION AND CONSUMPTION
J. M. Giovannoni and A. Junod *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 157-193 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

N78-25485 World Meteorological Organization, Geneva (Switzerland).
GLOBAL AIR POLLUTION
R. E. Munn *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 197-214 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

N78-25486 World Meteorological Organization, Geneva (Switzerland).
TRANSPORT AND DISPERSION OF AIR POLLUTION ON A REGIONAL SCALE
Antii Kulmala *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 215-228 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

N78-25488 World Meteorological Organization, Geneva (Switzerland).
ON AIR-BORNE TRANSPORT OF SULPHUR OVER THE NORTH ATLANTIC
Alf Nyberg *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 241-253 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

N78-25490 World Meteorological Organization, Geneva (Switzerland).
AIR POLLUTION POTENTIAL FORECASTING
Richard L. Bailey *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 272-275 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

N78-25491 World Meteorological Organization, Geneva (Switzerland).
EXAMPLES OF THE VISUALIZATION OF METEOROLOGICAL PROCESSES RELEVANT TO AIR POLLUTION DYNAMICS AND FORECASTING
Guenter Warnecke *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 276-288 (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

N78-25493 World Meteorological Organization, Geneva (Switzerland).
THE URBAN ATMOSPHERE AS AN ENVIRONMENT FOR AIR POLLUTION DISPERSION
T. R. Oke *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 316-341 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

N78-25494 World Meteorological Organization, Geneva (Switzerland).
STRATOSPHERIC POLLUTION
J. P. Friend *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 342-350 (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N78-25703*# Maryland Univ., College Park.
VERY LONG BASELINE INTERFEROMETRY APPLIED TO POLAR MOTION, RELATIVITY, AND GEODESY Ph.D. Thesis
Chopo Ma 1978 386 p refs
(Contracts NAS7-100; NAS5-22843; Grants NsG-5035; NGR-22-009-839; Contracts ARPA-23601-71-0092; DI-14-08-001-14148; Grants NSF EAR-76-22615; NSF GP-25865)
(NASA-CR-157212) Avail: NTIS HC A17/MF A01 CSCL 08B

The causes and effects of diurnal polar motion are described. An algorithm was developed for modeling the effects on very long baseline interferometry observables. A selection was made between two three-station networks for monitoring polar motion. The effects of scheduling and the number of sources observed on estimated baseline errors are discussed. New hardware and software techniques in very long baseline interferometry are described. Author

N78-25704*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
RADIATION MEASUREMENTS FROM POLAR AND GEOSYNCHRONOUS SATELLITES Final Report, 10 Oct. 1970 - 31 Jul. 1978
Thomas H. VonderHaar, Stanley Q. Kidder, Donald W. Hillger, and James S. Ellis Jun. 1978 181 p refs
(Grant NGR-06-002-102)
(NASA-CR-157220) Avail: NTIS HC A09/MF A01 CSCL 04A

The following topics are discussed: (1) cloud effects in climate determination; (2) annual variation in the global heat balance of the earth; (3) the accuracy of precipitation estimates made from passive microwave measurements from satellites; (4) seasonal oceanic precipitation frequencies; (5) determination of mesoscale temperature and moisture fields over land from satellite radiance measurements; and (6) Nimbus 6 scanning microwave spectrometer data evaluation for surface wind and pressure components in tropical storms. G.G.

N78-25705# Japan Meteorological Agency, Tokyo.
REPORT OF THE KAKIOKA MAGNETIC OBSERVATORY, GEOMAGNETISM; CHICHIJIMA, 1973 - 1976
1978 19 p ref
(Rept-110) Avail: NTIS HC A02/MF A01

A summary of the results of the geomagnetic observations at Chichijima, of the Bonin Islands, is given. The Chichijima Magnetic Observatory is situated on the slope of Mt. Mikazukiyama in the northern part of Chichijima, which is one of the largest islands of the Bonins and at a distance of about 1000 km to the south of Tokyo. Author

N78-25706# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
LOW-ENERGY PLASMA OBSERVATIONS AT SYNCHRONOUS ORBIT
Walter Lennartssen and David L. Reasoner Aug. 1977 60 p refs
(TRITA-EPP-77-22) Avail: NTIS HC A04/MF A01

The auroral particles experiment on the ATS-6 satellite in synchronous orbit has detected a low energy plasma population which is separate and distinct from both the ring current and plasma sheet populations. The density and temperature of this low energy population were highly variable, with temperatures in the range kT = 1 to 30 eV and densities ranging from less than 1 cm/3 to more than 10 cm/3. The occurrence of a dense low energy plasma is most likely in the afternoon and dusk local time sectors, whereas n > 1 cm/3 is seen in the local night sector only during magnetically quiet periods. These observations suggest that this plasma is the outer zone of the plasmasphere. During magnetically active periods, this low energy plasma is ofter observed flowing sunward. In the dusk sector, enchanced plasma flow is ofter found about 1 to 2 hours prior to the onset of a substorm-associated particle injection. Author

N78-25707*# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
OBSERVATIONS OF AURORAL FADING BEFORE BREAKUP
Risto J. Pellinen and Walter J. Heikkila (Texas Univ. at Dallas, Richardson) Feb. 1978 40 p refs
(Contract NGR-44-004-150; Contract F19628-75-C-0032)
(NASA-CR-157045; TRITA-EPP-78-05) Avail: NTIS HC A03/MF A01 CSCL 04A

The onset of auroral breakup was studied by using a variety of instruments with time resolution of some tens of second. Rapid sequences of all-sky photographs, and fast meridian scans by photometers, show that breakup is usually preceded by moderate brightening, followed by fading of the auroral brightness lasting one or two minutes, before the actual breakup itself. This optical activity is closely correlated with the development of auroral radar echoes. Data from a magnetometer network provide some indication of a correlated response by the local auroral and ionospheric currents. Riometer recordings show a slow decrease in ionspheric radio wave absorption over a period of about ten minutes prior to breakup, with the largest decrease essentially to quiet-time values in the region of auroral fading and subsequent breakup. Author

N78-25708*# National Aeronautics and Space Administration, Washington, D. C.
TABLES OF SPECTRAL TRANSMISSION OF THE ATMOSPHERE IN THE 2660-2750 cm(-1)AND 810-980 cm(-1) RANGES
May 1978 72 p ref Transl. into ENGLISH of "Tablitsy Spektralnogo Propuskaniya Atmosfery i Diapazonakh 2660-2750 cm(-1) i 810-980 cm(-1)", Rept. Joint Sov.-Am. Working Group on Space Meteorol., Acad. of Sci. USSR, Apr. 1978 34 p Transl. by Transemantics, Inc., Washington, D. C. Original doc. prep. by Acad. of Sci. USSR
(Contract NASw-2792)
(NASA-TM-75104) Avail: NTIS HC A04/MF A01 CSCL 04A

Thermal sounding data from satellites are presented together with a description of transmission function calculations. Tables contain experimental values for transmission of the entire thickness of the atmosphere for two regions of the spectrum: at 2660 to 2750 cm/1 and at 810 to 980 cm/1. The spectrum was recorded on an infrared spectrophotometer. G.G.

N78-25709# National Oceanic and Atmospheric Administration, Boulder, Colo.
UNITED STATES EARTHQUAKES, 1975
Jerry L. Coffman, ed. and Carl W. Stover, ed. 1977 142 p
(PB-278261; NOAA-78012604) Avail: NTIS HC A07/MF A01 CSCL 08K

Descriptions are presented of all earthquakes that occurred in the United States and nearby territories in 1975. Its purpose is to provide a continuous history of the U.S. earthquakes for use in seismic risk studies, site evaluations for nuclear powerplants, design of earthquake-resistive structures, and for answering inquiries from the scientific and general public. Each description includes date, origin time, epicenter, and epicenter source of the earthquake, maximum intensity, (Modified Mercalli), and macroseismic effects reported in the area. GRA

N78-25710# Lowell Univ. Research Foundation, Mass.
EFFECTS OF NON-THERMAL ELECTRONS ON THE MORPHOLOGY OF THE TOP-SIDE IONOSPHERE Final Report, 1 Dec. 1976 - 30 Nov. 1977
Madhoo Kanal Nov. 1977 35 p refs
(Contract F19628-77-C-0065)
(AD-A053232; ULRF-385/CAR; AFGL-TR-77-0253) Avail: NTIS HC A03/MF A01 CSCL 04/1

This report contains a summary of the study of hyperthermal electron transport in the temperate, the precipitation, and the polar regions of the top-side ionosphere. It accounts for the electron energy loss to the neutral atmospheric species and the continuous loss to the ambient thermal plasma. The pitch angle scattering of hyperthermal electrons by the neutral species and ambient plasma is taken into account. A basic equation of transport, analogous to the Boltzmann's type of an equation, was derived to obtain the distribution function. A discovery of a variational principle was made to deal with the empirically fitted data of the scattering experiments. A complete set of

models was arrived at to treat the aforementioned three regions of the top-side ionosphere. Author (GRA)

N78-25711# Aerospace Corp., El Segundo, Calif.
ION CYCLOTRON WAVES GENERATED BY AN IONOSPHERIC BARIUM INJECTION Interim Report
Harry C. Koons and Morris B. Pongratz (Los Alamos Scientific Lab., New Mexico) 13 Mar. 1978 24 p refs
(Contract F04701-77-C-0078)
(AD-A052841; TR-0078(3960-06)-1; SAMSO-TR-78-66) Avail: NTIS HC A02/MF A01 CSCL 20/9

A shaped-charge, barium, plasma-injection experiment was performed in June 1976 at the ERDA Kauai Test Facility. The barium was injected perpendicular to the geomagnetic field at an altitude of 450 km. The second stage of the rocket, located approximately 1.2 km from the point of detonation, contained a payload to measure dc and ac electric fields using a dual spherical-probe antenna. A variety of plasma waves were detected for approximately 20 sec following the detonation. The initial impulse generated ion cyclotron waves at the Ba(+), O2(+), Al(+), OH(+), and O(+) gyrofrequencies. This was followed by a time period during which ion cyclotron waves were observed in passbands between the barium gyrofrequency harmonics up to the oxygen gyrofrequency. At the high frequency end of this range of the spectrum is essentially continuous, i.e., similar to an ion sound wave spectrum. Author (GRA)

N78-25712# Denver Research Inst., Colo. Div. of Mathematical Sciences.
A VELOCITY INVERSION PROCEDURE FOR ACOUSTIC WAVES
Jack K. Cohen and Norman Bleistein 22 Aug. 1977 31 p refs
(Contracts N00014-76-C-0039; N00014-76-C-0079)
(AD-A052912; MS-R-7803) Avail: NTIS HC A03/MF A01 CSCL 08/11

An approximate solution is presented to the seismic inverse problem for two dimensional velocity variations. The solution is given as a multiple integral over the data observed at the upper surface. An acoustic model is used and the reflections are assumed to be sufficiently weak to allow a linearization procedure in the otherwise non-linear inverse problem. Synthetic examples are presented demonstrating accuracy of the method with dipping planes at angles up to 45 deg and with velocity variations up to 20%. The method was also tested under automatic gain control, in which case velocity estimates were lost but the method nonetheless successfully migrated the data. Author (GRA)

N78-25713# Texas Univ. at Dallas, Richardson.
AURORAL DATA ANALYSIS Scientific Report, 1 Aug. 1976 - 31 Jul. 1977
J. David Winningham, Walter J. Heikkila, and Gordon G. Shepherd 4 Jan. 1978 52 p
(Contract F19628-76-C-0005)
(AD-A053262; AFGL-TR-78-0008) Avail: NTIS HC A04/MF A01 CSCL 04/1

Three papers have been published in journals. Each deals with the effects produced by auroral particles on the ionosphere and atmosphere and in turn with how the dynamics of auroral particles is influenced by terrestrial and interplanetary magnetic activity. GRA

N78-25714# Texas Instruments, Inc., Dallas. Equipment Group.
VELA NETWORK EVALUATION AND AUTOMATIC PROCESSING RESEARCH Quarterly Report, 1 Oct. - 31 Dec. 1977
Robert L. Sax 3 Jan. 1978 47 p
(Contract F08606-77-C-0004; ARPA Order 2551)
(AD-A052872; TI-ALEX(01)-QR-77-05) Avail: NTIS HC A03/MF A01 CSCL 17/10

Work in the following areas is summarized: (1)SRO Evaluation; (2)Detection, Waveform Extraction, and Magnitude Estimation; (3)Event Identification Study; (4)Surface Wave Study; and (5)Seismic Data Management. GRA

N78-25715# Rice Univ. Houston, Tex.
STUDY OF PLASMA FLOW NEAR THE EARTH'S PLASMAPAUSE Final Report, 1 Oct. 1976 - 30 Sep. 1977
M. Harel, R. A. Wolf, P. H. Reiff, and H. K. Hills 28 Nov. 1977 58 p refs
(Contracts F19628-77-C-0012; F19628-77-C-0005; AF Proj. 2311)
(AD-A053291; AFGL-TR-77-0286) Avail: NTIS HC A04/MF A01 CSCL 08/14

The first simulation run of a magnetospheric substorm was successfully completed. The computer program was developed to simulate aspects of the behavior of the closed-field-line portion of the earth's magnetosphere, and the auroral and subauroral ionosphere, during a magnetospheric event. The program self-consistently computes electric fields, electric currents, and plasma flow velocities in these regions. The basic program has been run for several idealized cases, and various output and plotting routines have been developed. Electron-flux data and polar-cap electric-field data from the S3-2 satellite have been used to specify input for the program. Computed electric fields in the auroral zone have been compared with measurements from the S3-2 satellite, and the agreement is found to be reasonably good considering that this is our first try. Various features of the data are interpreted in terms of the model. The computed time-evolution of the particle distribution near geosynchronous orbit agrees reasonably well with what is normally observed by McIlwain and collaborators during substorms. GRA

N78-25716# Environmental Research and Technology, Inc., Concord, Mass.
DEVELOPMENT OF THE RADIATIVE TRANSFER PORTION OF A 1-D PHOTOCHEMICAL DIFFUSIVE STRATOSPHERIC MODEL Final Report, 2 Jun. 1977 - 2 Mar. 1978
Ronald G. Isaacs, Hsiao-Hua K. Burke, Nancy Tripp, and Nien Dak Sze Mar. 1978 144 p refs
(Contract F19628-77-C-0078)
(AD-A053284; ERT-P-2994F; AFGL-TR-77-0293) Avail: NTIS HC A07/MF A01 CSCL 04/1

This report summarizes the development and implementation of an advanced state-of-the-art computer code, the Chlorine Model Study Program (CMSP), which models the trace gas composition of the atmosphere from the surface to 80 km employing over sixty relevant chemical reactions and parameterizing vertical transport by a selected eddy diffusion profile. A significant feature is the computation of solar flux available for photolysis by a multiple scattering atmosphere including the effect of surface reflection. Program documentation includes a complete listing of the code, a detailed flow chart, and several test case results in addition to a detailed program description and users guide. Author (GRA)

N78-25717# Ohio State Univ., Columbus. Dept. of Geodetic Science.
RECOVERY OF 5 DEGREES MEAN GRAVITY ANOMALIES IN LOCAL AREAS FROM ATS-6/GEOS-3 SATELLITE TO SATELLITE RANGE-RATE
D. P. Hajela Sep. 1977 86 p refs
(Contract F19628-76-C-0010)
(AD-A053233; DGS-259; AFGL-TR-77-0272; SR-11) Avail: NTIS HC A05/MF A01 CSCL 08/5

The recovery of 5 deg equal area mean anomalies is investigated from ATS-6/GEOS-3 SST real range-rate data using the least squares collocation method. The observational errors can be very satisfactorily filtered out by using piecewise continuous cubic splines (with continuous first and second derivatives) to fit the range-rate data in the least squares sense. The accelerations are obtained by analytical differentiation of the fitted spline. The accelerations are obtained optimally, matching the smoothness characteristics expected at GEOS-3 altitudes, if the nodes of the spline, where adjacent cubic polynomials meet, are kept every 60 seconds to fit range-rate observations at 10 seconds interval. GRA

N78-25718# Brookhaven National Lab., Upton, N. Y. Atmospheric Sciences Div.
STATISTICAL CORRELATIONS OF THE WAVE-INDUCED ATMOSPHERIC TURBULENCE OVER THE SEA
S. SethuRamam 1977 13 p refs Presented at the 5th Conf. on Probability and Statistics in Atmospheric Sci., Las Vegas, Nev., 15 Nov. 1977
(Contract EY-76-C-0016)

(BNL-23146; Conf-771103-1) Avail: NTIS HC A02/MF A01

Micro-meteorological processes that take place in the atmospheric surface layer over oceans are studied by analyzing the perturbance of the wind field due to the propagation of waves. When waves progress in water they induce an airflow in the initially still air close to the waves with the mean component in the direction of the waves. Over an open ocean, such a situation commonly occurs when waves with swell frequencies propagate in a locally calm meteorological condition. The influence of the swells is felt even when there is a moderate wind locally. Another characteristic of the above process is the perturbations in wind velocity fluctuations due to the presence of the waves. Data are reviewed from several theoretical and field studies on disturbances. ERA

N78-25719# Mound Lab., Miamisburg, Ohio.
GEOCHEMICAL CHARACTERIZATION OF DEVONIAN GAS SHALE
Ronald E. Zielinski 1977 24 p refs Presented at the Eastern Gas Shale Program Conf., Morgantown, W. Va., 17 Oct. 1977
(Contract EY-76-C-04-0053)
(MLM-2467(OP); Conf-771038-4) Avail: NTIS HC A02/MF A01

Detailed geochemical analyses are being used to provide an accurate assessment of the oil and gas resources present in the Devonian shales in the Appalachian and Illinois Basins. The suite of geochemical analyses is designed to evaluate the organic richness, the hydrocarbon potential, the type of organic matter and the thermal maturity of the organic matter. Laboratory techniques such as pyrolysis gas chromatography and mass balance thermal extraction were also employed to measure thermally derived oil and gas yields from the Devonian shales. Stable carbon isotope geochemistry has also been initiated. The first phase of this study involved the determination of stable carbon isotope values for shale core samples. ERA

N78-25720# Mound Lab., Miamisburg, Ohio.
PHYSIOCHEMICAL CHARACTERIZATION OF DEVONIAN GAS SHALE
R. E. Zielinski, A. Attalla, E. Stacy, B. D. Craft, and R. L. Wise 1977 24 p refs Presented at the Eastern Gas Shale Program Conf., Morgantown, W. Va., 17 Oct. 1977
(Contract EY-76-C-04-0053)
(MLM-2466(OP); Conf-771038-3) Avail: NTIS HC A02/MF A01

Several physicochemical analyses are being performed to better characterize the Devonian gas shales located in the Appalachian and Illinois Basins. The results of these analyses are being integrated with the geochemical analyses to present an accurate characterization of the Devonian shales and to accurately assess their resource potential. These studies are also providing data that are being used to evaluate the physical behavior of the shales. ERA

N78-25721# California Univ., Livermore. Lawrence Livermore Lab.
OZONE DESTRUCTION BY CATALYSIS: CREDIBILITY OF THE THREAT
H. W. Ellsaesser May 1977 21 p refs Presented at Fall Meeting of the Am. Geophysical Union, San Francisco, 6 Dec. 1976 Revised
(Contract W-7405-eng-48)
(UCRL-78627-Rev-1; Conf-761229-3) Avail: NTIS HC A02/MF A01

In an effort to assess the credibility of predictions concerning the O3 layer and to pinpoint avenues for improving current stratospheric models, a review was undertaken of observational data believed to have a bearing on the validity of destruction of stratospheric O3 by catalysis. Aside from short period responses of O3 above 20 km to PCA's and changes in solar flux, no data were found to confirm catalytic destruction both qualitatively and quantitatively. Predicted changes following such perturbations as nuclear tests, solar cycle modulation of cosmic rays, PCA's and volcanic eruptions cannot be clarly identified in the total O3 observations. Observed variations in total O3 appear to have been controlled by processes not included in current stratospheric models. As a minimum, it is concluded that predictions regarding stratospheric O3 do not, at present, warrant the confidence implied by CIAP. ERA

N78-25722# California Univ., Livermore. Lawrence Livermore Lab.
HYDROGEOCHEMICAL AND STREAM-SEDIMENT SURVEY OF THE NATIONAL RESOURCE EVALUATION (NURE) PROGRAM: WESTERN UNITED STATES Quarterly Progress Report, Apr. - Jun. 1977
20 Sep. 1977 16 p
(Contract W-7405-eng-48)
(UCID-16911-77-2) Avail: NTIS HC A02/MF A01

Field work was completed for two reconnaissance sampling projects in southern Nevada and California and a reconnaissance sampling project in western Utah and eastern Nevada was started. Sampling was also completed for two orientation study areas in Arizona and planning and site selections finalized for two reconnaissance sampling projects in Nevada. The Great Basin groundwater sampling program continued on schedule. Although the instrumental neutron-activation analysis facility operated in automatic mode, hardware, and software development are continuing to increase reliability and facilitate automatic data processing. Procedures and equipment for generation precision map overlays and digitizing map data are nearly complete. ERA

N78-25723# Los Alamos Scientific Lab., N. Mex.
MAGNETIC INDUCTION TECHNIQUE FOR MAPPING VERTICAL CONDUCTIVE FRACTURES Status Report
J. A. Landt, J. C. Rowley, J. W. Neudecker, and A. R. Koelle Dec. 1977 11 p refs
(Contract W-7405-eng-36)
(LA-7049-SR) Avail: NTIS HC A02/MF A01

Fracture mapping techniques are summarized, and their merits discussed. Of these methods, one based on magnetic induction appeared to be well suited for the hot dry rock application. As of August 1977, the status is given here of the development of a fracture mapping instrument using magnetic induction. The basic analysis and electronic design were completed. Detailed mechanical design and fabrication remain. ERA

N78-25724# GeoEnergy Corp., Las Vegas, Nev.
ROCK GEOMETRY/MECHANICS STUDY OF THE WESTERN TIGHT GAS RESERVOIRS
Sep. 1977 180 p refs Prepared for Calif. Univ., Livermore. Lawrence Livermore Lab.
(Contract W-7405-eng-48)
(UCRL-13778) Avail: NTIS HC A09/MF A01

Generally available information about the generalized structure, stratigraphy, rock geometry, and rock properties is presented for the Cretaceous and Tertiary media which contain the gas resources in the western tight gas sands. These media consist primarily of blanket type marine sandstones and complex continental lenses that are internally quite heterogeneous. General geologic descriptions are presented. Considerable uncertainty exists with respect to the values obtained for the mechanical and reservoir properties of the tight gas sands in these basins. Mechanical properties vary considerably, even within the sandstone lenses themselves. Ranges for estimated average values for permeability and gas filled porosity for four basins are tabulated. ERA

N78-25725# National Technical Information Service, Springfield, Va.
SEISMIC DETECTION. PART 1: GENERAL STUDIES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1978
Guy E. Habercom, Jr. Mar. 1978 289 p Supersedes NTIS/PS-77/0234; NTIS/PS-76/0206; NTIS/PS-75/326 (NTIS/PS-78/0251; NTIS/PS-77/0234; NTIS/PS-76/0206; NTIS/PS-75/326) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 08K

General applications of seismic detection and seismic arrays are investigated in these research reports. Earthquake detection, personnel detection, and vehicle detection are reviewed. GRA

N78-25726# National Technical Information Service, Springfield, Va.
SEISMIC DETECTION. PART 2: NUCLEAR EVENTS,

VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1975 - Feb. 1978
Guy E. Habercom, Jr. Mar. 1978 297 p Supersedes NTIS/PS-77/0228; NTIS/PS-76/0209; NTIS/PS-75/328 (NTIS/PS-78/0252; NTIS/PS-77/0228; NTIS/PS-76/0209; NTIS/PS-75/328) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 08K

Methods of seismic detection of nuclear events are investigated in the Government sponsored research reports. Data acquisition techniques, data processing, and data collection sources are reviewed. GRA

N78-25727# Arizona State Univ., Tempe. Dept. of Anthropology.
ARCHAEOLOGICAL INVESTIGATION OF THE GRANITE REEF AQUEDUCT, CAVE CREEK ARCHAEOLOGICAL DISTRICT, ARIZONA Final Report
James B. Rodgers Dec. 1977 199 p refs
(Contract DI-14-06-330-21)
(PB-277395; RP-12) Avail: NTIS HC A09/MF A01 CSCL 08G

The Cave Creek Archaeological District contains a total of 25 sites reflecting varied domestic and subsistence activities. The majority of these sites form a homogeneous archaeological complex that suggests Hohokam expansion from the Salt River Valley. Local occupation was permanent but limited to less than 150 years. Relative and chronometric dating techniques bracket this occupancy between A.D. 1010 and 1130. An appended portion of this report employs palynological information to equate the initial use of the Cave Buttes area with a climatic period of increased moisture. Local prehistoric abandonment suggests an inability to cope with a subsequent climatic shift to more xeric conditions. GRA

N78-25487 World Meteorological Organization, Geneva (Switzerland).
ATMOSPHERIC DIFFUSION FUNDAMENTALS FOR AIR POLLUTION APPLICATIONS
F. A. Gifford, Jr. *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 229-240 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

N78-25489 World Meteorological Organization, Geneva (Switzerland).
TURBULENT DIFFUSION
A. S. Zaitsev *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 259-271 refs (For availability see N78-25473 16-42)
Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N78-25728 Direction de la Meteorologie Nationale, Paris (France).
THE WEATHER IN THE MARQUESAS ISLANDS. CLIMATOLOGICAL SURVEY [LE TEMPS DANS L'ARCHIPEL DES ILES MARQUISES. APERCU CLIMATOLOGIQUE]
G. Cauchard and J. Inchauspe Nov. 1977 36 p refs In FRENCH
(MN-Mono-100) Avail: Issuing Activity

A climatological summary of weather measurements since 1960 is given for the Marquesas area. ESA

N78-25729 Direction de la Meteorologie Nationale, Paris (France).
PRECIPITATION INTENSITY OVER THE LAMENTIN AIRPORT [INTENSITE DES PRECIPITATIONS SUR L'AERODROME DU LAMENTIN]
A. Fayolle Nov. 1977 48 p refs In FRENCH
(MN-Mono-103) Avail: Issuing Activity

Rainfall values over the Lamentin airport were collected over a period of 16 years. Various curves are derived from the rain data. ESA

N78-25730 Deutscher Wetterdienst, Offenbach am Main (West Germany).
REPORTS FROM THE GERMAN METEOROLOGICAL SERVICE. VOLUME 18, NO. 143: THE CLIMATE OF SELECTED PLACES IN THE FEDERAL REPUBLIC OF GERMANY. HANNOVER: STATISTICAL EVALUATIONS AND EXPLANATIONS FOR USE IN APPLIED CLIMATOLOGY [BERICHTE DES DEUTSCHEN WETTERDIENSTES NR. 143 (BAND 18). DAS KLIMA AUSGEWAEHLTER ORTE DER BUNDESREPUBLIK DEUTSCHLAND. HANNOVER: STATISTISCHE AUSWERTUNGEN UND ERLAEUTERUNGEN FUER ZWECKE DER ANGEWANDTEN KLIMATOLOGIE]
Margret Kalb and Helmut Schmidt 1977 273 p refs In GERMAN; ENGLISH summary
(ISBN-3-88148-153-2) Avail: Issuing Activity

This climatological analysis of Hannover describes in detail the most relevant climatic elements and contains more than 200 tables and figures from the period 1951 to 1970. Monthly values, mean values, frequencies, and totals of the different elements are shown. Frequency distributions of some combined elements offer a general survey of the statistic connections existing between two combined elements. The climatological analysis is based on climatological observations made at 07, 14, and 21 mean local times as well as hourly synoptic observations and evaluations of recordings. Author (ESA)

N78-25731*# Aeronautical Research Associates of Princeton, Inc., N. J.
TURBULENT TRANSPORT MODEL OF WIND SHEAR IN THUNDERSTORM GUST FRONTS AND WARM FRONTS
W. S. Lewellen, M. Teske, and H. Segur Washington NASA May 1978 68 p refs
(Contract NAS8-32037)
(NASA-CR-3002; ARAP-327) Avail: NTIS HC A04/MF A01 CSCL 04B

A model of turbulent flow in the atmospheric boundary layer was used to simulate the low-level wind and turbulence profiles associated with both local thunderstorm gust fronts and synoptic-scale warm fronts. Dimensional analyses of both type fronts provided the physical scaling necessary to permit normalized simulations to represent fronts for any temperature jump. The sensitivity of the thunderstorm gust front to five different dimensionless parameters as well as a change from axisymmetric to planar geometry was examined. The sensitivity of the warm front to variations in the Rossby number was examined. Results of the simulations are discussed in terms of the conditions which lead to wind shears which are likely to be most hazardous for aircraft operations. Author

N78-25732*# Arizona State Univ., Tempe. Engineering Research Center.
A COMPARISON OF WAKE CHARACTERISTICS OF MODEL AND PROTOTYPE BUILDINGS IN TRANSVERSE WINDS
Earl Logan, Jr., Prapoj Phataraphruk, and Jingfa Chang May 1978 56 p refs
(Contract NAS8-32357)
(NASA-CR-3008; ERC-R-78008) Avail: NTIS HC A04/MF A01 CSCL 04B

Previously measured mean velocity and turbulence intensity profiles in the wake of a 26.8-m long building 3.2 m high and transverse to the wind direction in an atmospheric boundary layer several hundred meters thick were compared with profiles at corresponding stations downstream of a 1/50-scale model on the floor of a large meteorological wind tunnel in a boundary layer 0.61 m in thickness. The validity of using model wake data to predict full scale data was determined. Preliminary results are presented which indicate that disparities result from differences in relative depth of logarithmic layers, surface roughness, and the proximity of upstream obstacles. Author

N78-25733# Naval Postgraduate School, Monterey, Calif.
STRUCTURE OF SYNOPTIC-SCALE WAVES IN THE TROPICAL PACIFIC DURING JULY - DECEMBER 1974 - 1976 M.S. Thesis
Donald Joseph Bepristis Dec. 1977 38 p refs

(AD-A052659) Avail: NTIS HC A03/MF A01 CSCL 04/2

Wave structures, sea-surface temperatures SST, and mean zonal winds are studied for the period July through December over the three consecutive years 1974, 1975 and 1976. These three years were found to possess an 'average' SST anomaly distribution, a cold anomaly pattern and a warm anomaly pattern respectively. Radiosonde data for the six month period for each year and each of the six locations Koror, Yap, Truk, Ponape, Kwajalein and Majuro were analyzed to derive composite wave descriptions of meridional and zonal wind components, temperature and specific humidity. The basic results such as periodicity and structural tilt were generally in agreement with previous research. Combining the SST data, mean zonal flow and wave composites leads to some new insights into the effects of the tropical SST on the semi-permanent Walker circulation and transient easterly waves. Results indicate that the east to west oscillation of the Walker circulation may be directly related to the tropical eastern Pacific SST. GRA

N78-25734# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.

TROPICAL CYCLONE CLOUD AND INTENSITY RELATIONSHIPS

Charles P. Arnold and William M. Gray Nov. 1977 165 p refs

(Contract DAEA18-77-C-0039; Grant NOAA-04-6-022-44036) (AD-A053044; CSU-ATSP-277) Avail: NTIS HC A08/MF A01 CSCL 04/2

This paper describes an observational study of tropical cyclones based on high resolution visual and infrared Defense Meteorological Satellite Program (DMSP) pictures of western North Pacific storms. It also utilizes composited rawinsonde data about storms in the same geographical region. It discusses the physical characteristics, cloud characteristics and wind and thermodynamic characteristics, associated with each of four stages of tropical cyclone development (developing cluster, tropical depression, tropical storm and typhoons). Among the physical characteristics discussed are typical storm sizes, types of banding most often observed, location and type of circulation center, intensification rates, and eye dimensions. Cloud characteristics include the percent of storm area covered by cirrus and convective cloud types and the distribution and characteristics of the basic convective element found in DMSP data. Among the wind and thermodynamic parameters investigated were vertical motion, vorticity, tangential wind, moisture and temperature. Author (GRA)

N78-25735# Air Force Geophysics Lab., Hanscom AFB, Mass.

PERSISTANCE, RUNS, AND RECURRENCE OF SKY COVER Environmental Research Papers

Iver A. Lund and Donald D. Grantham 30 Dec. 1977 53 p refs

(AD-A053199; AFGL-TR-77-0308; AFGL-ERP-621) Avail: NTIS HC A04/MF A01 CSCL 04/2

A total of 511, 056 hourly observations of total sky cover, taken over a thirteen year period at nine stations, was studied to obtain a better understanding of the characteristics of persistence, runs, and recurrence. Each hourly total sky cover observation was categorized as either zero-tenths (clear), less than or equal to three-tenths, greater than or equal to eight-tenths, or ten-tenths (overcast). Probabilities of each category were estimated from relative frequencies determined from this large data sample and were compared with some theoretical models. The models can be applied to estimate probabilities that any of the above sky cover categories will be observed for sequences of x hours, or more; for exactly x hours; or at time t and also at time t-x hours. Author (GRA)

N78-25474 World Meteorological Organization, Geneva (Switzerland).

RECENT CLIMATIC TRENDS

James K. Angell *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 3-20 refs (For availability see N78-25473 16-42)

Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

N78-25475 World Meteorological Organization, Geneva (Switzerland).

RESEARCH TRENDS IN ATMOSPHERIC BOUNDARY LAYER AND TURBULENCE

S. P. S. Arya *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 21-27 refs (For availability see N78-25473 16-42)

(Grant EPA-R-804653-01-1)

Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

N78-25480 World Meteorological Organization, Geneva (Switzerland).

METEOROLOGICAL INSTRUMENTS: THEIR SELECTION AND USE IN AIR POLLUTION STUDIES

Daniel A. Mazzarella *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 75-102 refs (For availability see N78-25473 16-42)

Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

N78-25483 World Meteorological Organization, Geneva (Switzerland).

THE METEOROLOGICAL ASPECTS OF PLANT INJURY BY AIR POLLUTION

E. I. Mukammal *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 146-156 refs (For availability see N78-25473 16-42)

Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

N78-25492 World Meteorological Organization, Geneva (Switzerland).

METEOROLOGICAL ASPECTS OF ENVIRONMENTAL IMPACT ASSESSMENT

James L. Dicke *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 289-309 refs (For availability see N78-25473 16-42)

Copyright. HC A17/MF A01; WMO, Geneva, Sw. Fr. 40

N78-25495 World Meteorological Organization, Geneva (Switzerland).

THE EFFECT OF ATMOSPHERIC POLLUTION ON CLIMATE

O. P. Petrenchuk and K. A. Hzmaljan *In its* Educ. and Training in Meteorol. Aspects of Atmospheric Pollution and Related Environ. Probl. 1977 p 351-372 refs (For availability see N78-25473 16-42)

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48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N78-25736# Rhode Island Univ., Kingston. Dept. of Ocean Engineering.

GENERATION OF TIDAL CURRENT AND HEIGHT CHARTS FOR NARRAGANSETT BAY USING A NUMERICAL MODEL

Craig Swanson and Malcolm Spaulding 1977 15 p refs

(Grant SG-04-6-158-44002)

(PB-278128; MTR-61) Avail: NTIS HC A02/MF A01 CSCL 08J

A series of tidal current and height charts were prepared for Narragansett Bay, Rhode Island utilizing a numerical model. The format of these charts was designed to allow the recreational user to easily determine the tidal currents and height at any location and time. The numerical model used was two dimensional, vertically averaged, multioperation, alternating direction implicit finite difference scheme. GRA

N78-25737# Woods Hole Oceanographic Institution, Mass.

DATA FILE: NEW BEDFORD HARBOR, MASSACHUSETTS

Jeffrey P. Ellis, Brian C. Kelley (Southeastern Mass. Univ., North Dartmouth), Peter Stoffers (Heidelberg Univ., West Germany), M. G. Fitzgerald (Exxon Production Res. Co., Houston, Tex.), and Colin Summerhayes, P. Dec. 1977 88 p refs

(Grants SG-04-6-158-44016; SG-04-6-158-44106)

(PB-278199; WHOT-77-73) Avail: NTIS HC A05/MF A01 CSCL 08J

The New Bedford Harbor project was designed to examine the past and present patterns of dispersal and accumulation of fine grained sediments and waste materials in New Bedford Harbor and its approaches. Topics covered are: water quality data, suspended matter, bottom sample locations and size analysis data, chemical data, and biological data. GRA

N78-25738# National Oceanic and Atmospheric Administration, Rockville, Md.
TIDE TABLES 1979. HIGH AND LOW WATER PREDICTIONS. WEST COAST OF NORTH AND SOUTH AMERICA INCLUDING THE HAWAIIAN ISLANDS
1978 236 p
(PB-278285; NOAA-78012002) Avail: NTIS HC A11/MF A01 CSCL 08J

Daily predictions are presented for 40 reference ports and differences and other constants for about 1,100 stations in North America, South America, and the Hawaiian Islands. Included is a table for obtaining the approximate height of the tide at any time, a table of local mean time of sunrise and sunset for every 5th day of the year for different lattitudes, a table for the reduction of local mean time to standard time, a table of moonrise and moonset for 6 places, a table of the Greenwich mean time of the times of the solar equinoxes and solstices. GRA

N78-25739# Woods Hole Oceanographic Institution, Mass.
MARINE RESOURCES DEVELOPMENT AND MANAGEMENT Annual Report, 1976 - 1977
David A. Ross Nov. 1977 29 p Sponsored by NOAA, Wash. D.C.
(PB-278287; NOAA-78013108) Avail: NTIS HC A03/MF A01 CSCL 08C

A review of Sea Grant projects in the following areas is presented: pollution problems within the coastal zone and effects of expanded jurisdiction of offshore waters; aquiculture; living resources: sociopolitical studies; ocean engineering; ecosystems research; pollution; environmental models; and marine education and training. GRA

N78-25740# Texas A&M Univ., College Station. Dept. of Range Science.
SHORELINE PLANT ESTABLISHMENT AND USE OF A WAVE-STILLING DEVICE
J. W. Webb and J. D. Dodd Jan. 1978 32 p refs
(Contract DACW72-74-C-0002)
(AD-A053285; CERC-MR-78-1) Avail: NTIS HC A03/MF A01 CSCL 13/2

The establishment and development of smooth cordgrass transplants on a 2 percent slope behind a wave-stilling device constructed of two tiers of tires strung on a cable were monitored along the north shore of East Bay in Texas. Two previous plantings on the sloped area, the first without wave protection and the second behind one tier of tires, were unsuccessful. After a second tier of tires was placed on top of the original tier, enough protection was provided from waves to allow successful planting. A 0.15 meter buildup of sediment occurred directly behind the barrier. Smooth cordgrass survival was approximately 50 percent and over 100 stems per meter squared were counted in some areas 1 year after planting. Density and height of smooth cordgrass increased with increasing hours of inudation. Rabbits apparently caused enough damage to plants outside a rabbit-proof fence that significant differences in density between fenced and unfenced areas occurred. With adequate wave protection, smooth cordgrass can be established below MHW in estuarine areas. Gulf cordgrass, marshhay cordgrass, and saltgrass can be used above MHW for shoreline protection. GRA

N78-25741# Coast Guard, Washington, D.C.
OCEANOGRAPHIC OBSERVATIONS. NORTH ATLANTIC OCEAN, STATION ECHO. TERMINAL REPORT, 1966-1973
Adrian W. Longacre Sep. 1977 696 p refs
(AD-A053045; USCG-373-72) Avail: NTIS HC A99/MF A01 CSCL 08/10

Observed temperature and salinity data, plus sigma-t values and sound velocities are presented for 1620 oceanographic stations occupied by U.S. Coast Guard Cutters at Ocean Station ECHO(centered at 35 deg 00:N, 48 deg 00:W) from January 1969 through June 1973. All data, including that previously reported, was averaged by month. Plots of average temperature and average salinity versus time and average depth of isotherms and isohalines versus time are plotted by month for all patrols since September 1966. Representative T-S diagrams are included along with a typical plot of the 1st standard deviation of the monthly average temperature and salinity versus depth. The various plots are analyzed to examine annual cycles at ECHO. The sea surface temperature at ECHO reaches a monthly average maximum of about 26 C in August and a minimum usually of about 18 C in March. The surface effects are largely limited to the upper 200 meters of the water column. A series of temperature and salinity cycles below 200 meters of two to three months duration, probably a barotropic response, is noted at intermediate depths. Also, dissolved oxygen measurements are analyzed for two cruises. GRA

N78-25742# Texas A&M Univ., College Station. Dept. of Oceanography.
DEVELOPMENT AND COORDINATION OF A PROGRAM OF ENERGY-RELATED OCEANOGRAPHIC RESEARCH AND THE CONTINENTAL SHELVES OF THE GULF OF MEXICO Progress Report, 1 Jan. 1976 - 30 Sep. 1977
T. K. Treadwell 1977 7 p
(Contracts EY-76-S-05-5017; E(40-1)-5017)
(ORO-5017-3) Avail: NTIS HC A02/MF A01

A workshop was organized to obtain inputs from scientists most familiar with the scientific problems in the Gulf shelf area. The results of this workshop are briefly summarized. Initial efforts at organization of the program are reported. ERA

N78-25743# National Oceanic and Atmospheric Administration, Seattle, Wash.
PHYSICAL OCEANOGRAPHY IN PUGET SOUND MAIN BASIN PROJECT REPORT, FISCAL YEAR 1976 AND 1976T
Dec. 1976 115 p refs
(PB-278256; NOAA-TM-ERL-MESA-18; NOAA-78012605)
Avail: NTIS HC A06/MF A01 CSCL 08J

Physical oceanographic research in the main basin of Puget Sound is described. The physics of three regional surface wind models were evaluated. A tidal current interpolation algorithm for the prediction of surface currents over all of Puget Sound was developed. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N78-25744# National Inst. of Dental Research, Bethesda, Md.
STUDIES ON THE ISOLATION AND IDENTIFICATION OF HEPATITIS VIRUSES IN WATER
W. O. K. Grabow and O. W. Prozesky (Natl. Inst. for Virology, Johannesburg) [1977] 9 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

Antigens associated with hepatitis viruses were successfully isolated from seeded water samples by means of affinity chromatography. The antibodies trap the virus particles, while non-specific material passes through. After washing, the antigens were released for identification in purified and concentrated form. The hepatitis B associated antigen was identified by means of radioimmunoassay and electron microscopy. Application of the procedure to waste water indicated that the hepatitis B virus is rarely present in polluted water. The hepatitis A associated agent was identified by infectivity tests using Saguinus nigricollis marmosets. Author

N78-25745# Newcastle-upon-Tyne Univ. (England).
INACTIVATION OF ENTEROVIRUSES AND COLIPHAGES WITH OZONE IN WATERS AND WASTE WATERS
Lilian M. Evison [1977] 12 p refs Presented at the Intern. Conf. on Advanced Treatment and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

The relative resistance of enteroviruses, coliphages and E.

coli was studied in laboratory experiments. Coxsackie B3 and Polio 3 were the most resistant strains, Coxsackie B5 and Polio 2 were the least resistant. Coliphages and E. coli were less resistant than any of the viruses. The effect on ozone disinfection of a range of organic and inorganic chemicals and waste water effluents was investigated. Author

N78-25746# Hebrew Univ., Jerusalem (Israel). School of Applied Science and Technology.

VIRUS CONCENTRATION BY HOLLOW FIBER MEMBRANES: WHERE TO NOW?

Georges Belfort, Yael Rotem-Borensztajn, and Elie Katzenelson [1977] 11 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater

Avail: NTIS HC A02/MF A01

An asymmetric polyamide capillary membrane ultrafiltration permeator was used to concentrate polio virus I from 100 l of tap water. Results of virus recovery through ultrafiltration, backwashing and second step concentration by organic flocculation are presented and represent a significant improvement over those previously reported. The importance of hydrodynamics is emphasized and used to compare the performance of the capillary module with that of two hollow fiber modules previously tested. Author

N78-25747# National Inst. for Water Research, Pretoria (South Africa).

BIOLOGICAL TESTING OF WATER RECLAIMED FROM PURIFIED SEWAGE EFFLUENTS

S. J. VanRensburg (Natl. Res. Inst. for Nutr. Diseases of the S. Africa Med. Res. Council, Tygerberg), W. H. J. Hattingh, M. L. Siebert, and N. P. J. Kriek [1977] 15 p refs Presented at the Intern. Conf. of Advan. Treat. and Reclamation of Wastewater

Avail: NTIS HC A02/MF A01

Four different waters (reclaimed, humus tank effluent, distilled and tap water were subjected to biological assay, using rats. In addition spent and new active carbon was also included in the diets of the rats to investigate the oral route. All animals were autopsied and the liver, kidneys, lungs, heart, spleen, pancreas, gonads, oesophagus, stomach, intestine and other abnormal tissues were fixed, stained and microscopically examined. Results indicate that the feed water to the reclamation plant (humus tank effluent) was the only water which exerted obvious deleterious effects on the test animals. Author

N78-25748# Technion - Israel Inst. of Tech., Haifa. Environmental Engineering Labs.

COLIPHAGES SURVIVAL AS VIRAL INDICATOR IN VARIOUS WASTEWATER QUALITY EFFLUENTS

Yehuda Kott, Hanna Ben-Ari, and Lina Vinokur [1977] 12 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater

(Grant EPA-801950)

Avail: NTIS HC A02/MF A01

The use of coliphages as a viral model in waste and other waters was investigated. Results and survival of coliphage after chlorination, suggest strongly that coliphage capable to attack E. coli B can be used as virus indicator in various wastewaters. Using coliphage as a viral indicator will save time, and is economically feasible. Author

N78-25749# National Inst. for Water Research, Pretoria (South Africa).

MICROBIOLOGICAL QUALITY AND EPIDEMIOLOGICAL ASPECTS OF RECLAIMED WATER

W. O. K. Grabow and Margaretha Isaacson (South African Inst. for Med. Res., Johannesburg) [1977] 11 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater

Avail: NTIS HC A02/MF A01

Potable waters obtained by conventional methods or by reclamation of wastewater, as well as their sources, were analysed for total bacterial plate count, total coliform bacteria, fecal coliforms, enteric viruses and parasite ova. The quality of the reclaimed water consistently compared favourably with those produced by conventional methods, and was substantially superior to that of many conventional supplies. These findings were supported by epidemiological data, which failed to reveal any adverse health effects on consumers of reclaimed or conventional supplies that conformed to the proposed standard. Author

N78-25750# Technion - Israel Inst. of Tech., Haifa. Sherman Environmental Engineering Research Center.

PHYSICO-CHEMICAL TREATMENT OF POND EFFLUENTS FOR UNRESTRICTED AGRICULTURAL REUSE WITH RECOVERY OF ALGAE AS PROTEIN SOURCE: PILOT AND FIELD SCALE EXPERIMENTS

G. Shelef, R. Moraine, and E. Sandbank [1977] 17 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater

Avail: NTIS HC A02/MF A01

Alum flocculation coupled with flotation was found to upgrade stabilization pond effluents to quality permitting reuse for unrestricted irrigation. Removal of phosphate by the alum permits seasonal impoundment of the clarified effluent with minimal eutrophication. The byproduct algal sludge can serve as a high quality protein source for poultry and fish, replacing over a quarter of the soymeal in broiler rations as well as over three-quarters of the fishmeal in carp rations. The combined values of waste disposal, renovated water, and feed protein make the system highly economical. Author

N78-25751# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).

RELATIONS BETWEEN LIGHT-INDUCED XANTHOPHYLL CONVERSION AND THE HILL REACTION

A. Hager 1978 19 p refs Transl. into ENGLISH from Ber. Deut. Bot. Ges. (West Germany), v. 79, no. 11, 1966 p 94-107

(NRC/CNR-TT-1921; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

The investigations were based on thin-layer chromatography, whereby even structure isomeric carotenoids, which vary only in the position of one double bond, can be separated from one another, such as lutein from zeaxanthin. The latter pigment, together with violaxanthin and antheraxanthin, plays an important role in such quantitative changes. The biosynthesis of carotenoids involves these three xanthophylls (violaxanthin, antheraxanthin and zeaxanthin) as end products. Whereas the concentrations of carotenes and of xanthophylls derived from alpha-carotene change only slowly and over long time intervals during plant ontogeny, it is possible to observe light induced, quantitative changes of the xanthophylls mentioned in a matter of minutes. Author

N78-25752*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

AUTOMATED TRACKING OF THE FLORIDA MANATEE (TRICHECHUS MANATUS) Final Report, Mar. 1977 - Jun. 1978

Robert C. Michelson, Jean Breedlove, and Herndon H. Jenkins Jun. 1978 172 p refs

(Contract NAS10-9097)

(NASA-CR-157040) Avail: NTIS HC A08/MF A01 CSCL 06C

The electronic, physical, biological and environmental factors involved in the automated remote tracking of the Florida manatee (Trichechus manatus) are identified. The current status of the manatee as an endangered species is provided. Brief descriptions of existing tracking and position locating systems are presented to identify the state of the art in these fields. An analysis of energy media is conducted to identify those with the highest probability of success for this application. Logistic questions such as the means of attachment and position of any equipment to be placed on the manatee are also investigated. Power sources and manateeborne electronics encapsulation techniques are studied and the results of a compter generated DF network analysis are summarized. Author

N78-25753# Johns Hopkins Univ., Baltimore, Md.

CHEMICAL PRODUCTION OF EXCITED STATES IN BIOLOGY: MECHANISM, REGULATION AND FUNCTION, RENEWAL PROPOSAL Tri-Annual Summary Report, 1 Jul. 1974 - 30 Jun. 1977

H. H. Seliger 1977 56 p

(Contract EY-76-S-02-3277)
(COO-3277-47) Avail: NTIS HC A04/MF A01

Molecular mechanisms studies are reported in bioluminescent reactions of fireflies, in purified calcium-activated photoproteins from marine microorganisms, and in marine dinoflagellates. The role of luciferase binding protein mechanisms in photon-stimulated bioluminescence is discussed. The use of chemiluminescence as an assay technique for nicotine in tobacco smoke and carcinogenic hydrocarbons in environmental samples is proposed and the requirements for such an assay system are reviewed. ERA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N78-25754*+ National Aeronautics and Space Administration, Washington, D. C.
A CUMULATIVE INDEX TO THE 1977 ISSUES OF A CONTINUING BIBLIOGRAPHY ON AEROSPACE MEDICINE AND BIOLOGY
Jan. 1978 401 p Supersedes the indexes contained in supplements NASA-SP-7011(164) through NASA-SP-7011 (175)
(NASA-SP-7011(176)) Avail: NTIS HC E05 CSCL 06E

This publication is a cumulative index to the abstracts contained in the Supplements 164 through 175 of Aerospace Medicine and Biology: A Continuing Bibliography. It includes three indexes-- subject, personal author, and corporate source. Author

N78-25755*+ National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING SUPPLEMENT 180, MAY 1978
May 1978 68 p
(NASA-SP-7011(180)) Avail: NTIS HC E02 CSCL 06E

This special bibliography lists 201 reports, articles, and other documents introduced into the NASA scientific and technical information system in April 1978. Author

N78-25756# National Inst. for Personnel Research, Johannesburg (South Africa).
THE ELECTROENCEPHALOGRAM IN AIRCREW SELECTION AND AVIATION MEDICINE: A SURVEY OF LITERATURE
B. D. Murdoch Jul. 1977 47 p refs
(CSIR-SR-PERS-268) Avail: NTIS HC A03/MF A01

The results of investigations and the contents of reports dealing with the utilisation of the EEG in aircrew selection and aviation medicine are considered under the following headings: the incidence of EEG abnormalities in normal candidates for flying training and in normal flying personnel: the relationship between the EEG and criteria based on the selection, training, and performance of flying personnel; altered states of consciousness related to epilepsy and other disorders; flicker and helicopter pilots; and the EEG monitoring of in-flight pilot stress. Conclusions based on the relevant literature are drawn at the end of each section. Author

N78-25757*# Southwest Research Inst., San Antonio, Tex. Electromagnetics Div.
EQUIPMENT DEVELOPMENT FOR AUTOMATIC ANTHROPOMETRIC MEASUREMENTS Final Report
J. P. Cater and W. E. Oakey 31 Mar. 1978 53 p
(Contract NAS9-15038; SwRI Proj. 16-4630)
(NASA-CR-151723) Avail: NTIS HC A04/MF A01 CSCL 06B

An automated procedure for measuring and recording the anthropometric active angles is presented. The small portable system consists of a microprocessor controlled video data acquisition system which measures single plane active angles using television video techniques and provides the measured data on sponsored-specified preformatted data sheets. This system, using only a single video camera, observes the end limits of the movement of a pair of separated lamps and calculates the vector angle between the extreme positions. Author

N78-25758*# West Florida Univ., Pensacola. Faculty of Physics.
A NOTE ON THE TISSUE STAR DOSE IN PERSONNEL RADIATION MONITORING IN SPACE
Hermann J. Schaefer Apr. 1978 17 p refs
(Contract NAS9-15417)
(NASA-CR-151724) Avail: NTIS HC A02/MF A01 CSCL 06R

Secondaries from nuclear interactions of high energy primaries in the body tissues themselves contribute substantially to the astronaut's radiation exposure in space. The so-called tissue star dose is assessed from the prong number distribution of disintegration stars in emulsion. Prong counts of 1,000 emulsion stars from the Apollo-Soyuz mission reported earlier were re-evaluated. The original scores were divided into sets of 250, 500, 750, and 1,000 emulsion stars and the respective prong number distributions established. The statistical error of the gelatin star number for the four consecutively larger was found to vary, on the 67 percent confidence level, from + or - 25 percent for the count of 250 emulsion stars to + or - 11 percent for 1,000 stars. Seen in the context of the other limitations of the experimental design, the lowest effort of prong-counting 250 stars appears entirely appropriate. Author

N78-25759*# Texas Inst. for Rehabilitation and Research, Houston. Biostereometrics Lab.
DEVELOPMENT OF BIOSTEREOMETRIC EXPERIMENTS Final Report, 1 Jan. - 31 Dec. 1977
R. E. Herron May 1978 73 p
(Contract NAS9-14562)
(NASA-CR-151726) Avail: NTIS HC A04/MF A01 CSCL 06B

The stereometric camera was designed for close-range techniques in biostereometrics. The camera focusing distance of 360 mm to infinity covers a broad field of close-range photogrammetry. The design provides for a separate unit for the lens system and interchangeable backs on the camera for the use of single frame film exposure, roll-type film cassettes, or glass plates. The system incorporates the use of a surface contrast optical projector. Author

N78-25760*# National Aeronautics and Space Administration. Pasadena Office, Calif.
BAG FOR STORING WHOLE BLOOD Patent Application
Herman Bank (JPL) and Edward L. Cleland, inventors (to NASA) (JPL) Filed 26 Jun. 1976 10 p
(Contract NAS7-100)
(NASA-Case-NPO-13930-1; US-Patent-Appl-SN-700467) Avail: NTIS HC A02/MF A01 CSCL 06B

The shelf life of stored whole blood may be doubled by adding a buffer which maintains a desired pH level. However, this buffer causes CO2 to be generated, which, if not removed at a controlled rate will shorten the life of the stored blood. A blood storage container was provided which will permit the CO2 to diffuse into the atmosphere, at a controlled rate, thereby maintaining the desired pH value while providing a bag strong enough to permit handling. NASA

N78-25761*# National Aeronautics and Space Administration. Pasadena Office, Calif.
COUPLING APPARATUS FOR ULTRASONIC MEDICAL DIAGNOSTIC SYSTEM Patent Application
Robert E. Frazer, inventor (to NASA) (JPL) Filed 15 Nov. 1976 10 p
(Contract NAS7-100)
(NASA-Case-NPO-13935-1; NASA-Case-NPO-13944-1; US-Patent-Appl-SN-741749) Avail: NTIS HC A02/MF A01 CSCL 06B

An apparatus is provided for assuring sonic coupling between transducers and a tissue to be ultrasonically diagnosed, without requiring the tissue to be immersed in a fluid or to be directly contacted by the transducers. The apparatus allows transducers to be moved relative to the tissue being scanned by utilizing a cavity with solid walls to receive the tissue, and by utilizing a vacuum to draw the tissue into intimate contact with the cavity walls. NASA

N78-25762*# National Aeronautics and Space Administration. Pasadena Office, Calif.
PROCESS FOR MANUFACTURING CANNULA Patent Application
Howard F. Broyles (JPL), Edward F. Cuddihy (JPL), and Jovan Moacanin, inventors (to NASA) (JPL) Filed 11 Jul. 1977 11 p Sponsored by NASA
(NASA-Case-NPO-14073-1; US-Patent-Appl-SN-814384) Avail: NTIS HC A02/MF A01 CSCL 06B

Manufacturing of a T shaped cannula is described. The tube was formed of dip-molded materials so that the opposite ends of the cross of the T taper to the smallest diameter. The process included dipping a tapered mandrel into dip-molding material and later removing the coating from the mandrel by dipping it into a swelling fluid which is absorbed by the coating material. A stub with a small diameter was inserted into the short end of the swelled coating; as the swelling agent evaporated, the short end of the coating shrank tightly around the stub to form a leak-tight seal. NASA

N78-25763# Wisconsin Univ., Madison. Dept. of Industrial Engineering.
DYNAMICS OF THE EYE AND HEAD DURING MOVEMENT BETWEEN DISPLAYS: A QUALITATIVE AND QUANTITATIVE GUIDE FOR DESIGNERS
Gordon H. Robinson Feb. 1978 33 p refs
(Contract N00014-75-C-0364; NR Proj. 197-028)
(AD-A052753; TR-78-2) Avail: NTIS HC A03/MF A01 CSCL 05/8

The purpose of this paper is to provide a designer or systems analyst as a guide to human performance limitations in vision when fixation must be redirected from one display to another. The focus is on large angular separation (greater than 20 degrees) and on tasks wherein speed is of importance. Patterns of eye and head movements are shown; as well as quantitative data on saccades, periods of eye/head compensation, and head movement. Independent variables include inter-display angle, display visibility, operator's knowledge of display location, and some relevant characteristics of a possible task which must be interrupted for the refixation. Inter and intra subject variability is also presented. Author (GRA)

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

No abstracts in this category.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N78-25764 South African Bureau of Standards, Pretoria.
STANDARD SPECIFICATION FOR THE PRODUCTION OF MEN'S PROTECTIVE SHOES WITH STUCK-ON PRE-MOULDED UNIT SOLES AND HEELS
Nov. 1977 42 p In AFRIKAANS and ENGLISH
(SABS-1167-1977; ISBN-0-626-04469-3) Copyright. Avail: Issuing Activity

Specifications are given for two types of men's protective shoes, made according to the stuck-on principle. Criteria for acceptance include chromic oxide content, pH, impact strength, bursting strength, wet stitch tear strength, and adhesion between layers. Sampling and inspection methods are given. M.V.

N78-25765 South African Bureau of Standards, Pretoria.
STANDARD SPECIFICATION FOR THE PRODUCTION OF MEN'S PROTECTIVE SHOES WITH DIRECT VULCANIZED SOLES AND HEELS
Nov. 1977 42 p In AFRIKAANS and ENGLISH
(SABS-1168-1977; ISBN-0-626-04470-7) Copyright. Avail: Issuing Activity

Specifications are given for two types of men's protective shoes, made according to the direct vulcanized principle. Criteria for acceptance include: pH, chromic oxide content, impact strength, bursting strength, wet stitch tear strength, and adhesion between layers. Sampling and inspection methods are also given. P.R.A.

N78-25766*# Texas A&M Univ., College Station. Dept. of Horticultural Sciences.
COMPRESSION OF REHYDRATABLE VEGETABLES AND CEREALS Annual Report, Feb. 1977 - Jan. 1978
E. E. Burns Jan. 1978 66 p refs
(Contract NAS9-12434)
(NASA-CR-151727) Avail: NTIS HC A04/MF A01 CSCL 06H

Characteristics of freeze-dried compressed carrots, such as rehydration, volatile retention, and texture, were studied by relating histological changes to textural quality evaluation, and by determining the effects of storage temperature on freeze-dried compressed carrot bars. Results show that samples compressed with a high moisture content undergo only slight structural damage and rehydrate quickly. Cellular disruption as a result of compression at low moisture levels was the main reason for rehydration and texture differences. Products prepared from carrot cubes having 48% moisture compared favorably with a freshly cooked product in cohesiveness and elasticity, but were found slightly harder and more chewy. G.G.

N78-25767*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
AN INVESTIGATION OF THE REDUCTION OF CARBON DIOXIDE IN A SILENT ELECTRIC DISCHARGE Final Report
Robert S. Luce and Barbara Greenough, ed. Jun. 1978 63 p refs
(Contract NAS2-9551)
(NASA-CR-152146; LMSC-D626407) Avail: NTIS HC A04/MF A01 CSCL 06K

The reduction of CO2 to O2 and CO in a silent electric discharge was studied. It was found that current alone (in the ionized plasma induced by the silent electric discharge) was reponsible for the CO2 reduction process. Voltage and frequency were important only in so far as they induced current in the plasma. Pressure and temperature were of minimum influence in the process. The large power consumption in the process was recognized as resulting from the low power factor of the reactor vessel which electrically behaved like a capacitor. The power factor was subsequently improved by adding an inductive element to make the reactor vessel capacitance part of a resonant circuit. It was found that the CO2 reduction process was most efficient in terms of power vs reduction rate when a voltage was employed that was only slightly higher than that needed to induce the plasma. Author

N78-25768# Ohio State Univ. Research Foundation, Columbus.
IDENTIFICATION OF FINITE STATE MODELS OF A HUMAN OPERATOR
Richard A. Miller, Ingjaldur Hannibalsson, and Samuel C. McNamee Dec. 1977 114 p
(Contract AF-AFOSR-3152-77; OSN Proj. 4556A1)
(AD-A053017; Rept-760518(MPN-784556); AFOSR-78-0617TR) Avail: NTIS HC A06/MF A01 CSCL 05/8

The abstract structure of the discrete control problem as it relates to manned systems has been refined and clarified. It has been shown that input-output data (information inputs to the operator, decision outputs from him) are representable by stochastic automata, a special type of discrete parameter, discrete state stochastic process. Further, the detailed structure of these systems has been examined and it has been shown that automata based on lth order state spaces (i.e., states are sequences of

outputs including the present and preceding 1-1 outputs) serve as excellent surrogates for more general systems. The results are a set of state transition matrices and probability distributions which stochastically characterize, as a function of the input when the operator will switch the mode of operation or configuration of the system and what the new configuration will be. The results show that finite state models of the human operator performing discrete control tasks can be developed and identified from data. They further verify the feasibility of using a hierarchical structure to avoid combinatorial problems and maintain identifiability. GRA

N78-25769# Gentex Corp., Carbondale, Pa.
OPTIMIZATION OF THE MATERIAL FOR CONSTRUCTION OF THE NEW PROTECTIVE MASK Final Report, 1 Jul. 1975 - 13 Jul. 1976
John P. Daugherty Sep. 1977 49 p
(Contract DAAA15-75-C-0175)
(AD-A053331; ARCSL-CR-77046) Avail: NTIS HC A03/MF A01 CSCL 06/17

Dow Corning's X4-2665 Silicone material provides an optical-and physical-property-wise satisfactory material for face masks. Production must observe critical processing and eliminate contaminates to provide a cost acceptable product. Prior to incorporation of this material into a full face mask, a lens design modification is required to provide optical clarity in the as-worn position. Author (GRA)

N78-25770# Applied Psychological Services, Wayne, Pa. Science Center.
HUMAN PERFORMANCE TRADEOFF CURVES FOR USE IN THE DESIGN OF NAVY SYSTEMS Final Report
Arthur I. Siegel, William Rick Leahy, and J. Jay Wolf Apr. 1978 59 p refs
(Contract N00024-76-C-6126)
(AD-A053332) Avail: NTIS HC A04/MF A01 CSCL 05/5

A series of human operator-system interdependencies is presented in the form of tradeoff curves. These curves were derived from computer simulation of a representative Navy mission. Performance at four work stations was simulated. The resulting tradeoff curves present the relative impact of human oriented variables on system performance. Such curves possess merit as an aid to the equipment system designers who possess an interest in improving both overall system reliability, maintainability, and availability. Author (GRA)

N78-25771# Webb Associates, Yellow Springs, Ohio.
COMPARATIVE ANTHROPOMETRY OF AIR STANDARDIZATION COORDINATING COMMITTEE PERSONNEL FOR EQUIPMENT DESIGN: HELMETS
John T. McConville and Charles E. Clauser (AMRL) Wright-Patterson AFB, Ohio AMRL Nov. 1977 17 p refs
(Contract F33615-76-C-5007; AF Proj. 7184)
(AD-A052893; AMRL-TR-77-77) Avail: NTIS HC A02/MF A01 CSCL 06/14

The objective of this report is to demonstrate that the comparability of body-size distributions of aircrew personnel of Air Standardization Coordinating Committee ASCC member nations is such that protective equipment sized and designed to fit personnel of one member nation will fit personnel of all member nations as well. The research reported in this publication compares the available anthropometry of the head and face of member ASCC nations, demonstrates their similarities, and tests the theoretical suitability of a Royal Aircraft Establishment RAE sizing program for helmets to accommodate U.S. Air Force USAF personnel. Author (GRA)

N78-25772# Michigan Univ., Ann Arbor. Highway Safety Research Institute.
SAFETY HELMET-HEAD INTERACTION STUDY USING HIGH-SPEED CINERADIOGRAPHY Final Report, 29 Aug. - 31 Oct. 1977
R. L. Stalnaker, M. Bender, and J. W. Melvin 31 Oct. 1977 42 p refs Sponsored by NIOSH
(PB-277289; UM-HSRI-77-48) Avail: NTIS HC A03/MF A02 CSCL 05H

Industrial safety helmets were subjected to impact force by an 8 lb spherical mass, dropped from a vertical height of 5 ft, while worn on the head of a seated dummy. The helmet head dynamic performance was evaluated by means of information obtained from 1000 frame per-second X-ray cinematography, and impactor and dummy head acceleration instrumentation. Peak and average forces, force durations, component and average resultant head accelerations were reported for each helmet type. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

N78-25773*# National Aeronautics and Space Administration, Washington, D. C.
PUBLICATIONS OF THE PLANETARY BIOLOGY PROGRAM FOR 1976: A SPECIAL BIBLIOGRAPHY
F. D. Bradley, comp. and R. S. Young, comp. 1977 40 p refs
(NASA-TM-75017) Avail: NTIS HC A03/MF A01 CSCL 03B

An annual listing of current publications resulting from research pursued under the auspices of NASA's Planetary Biology Program is presented. To stimulate the exchange of information and ideas among scientists working in the different areas of the program. To facilitate the exchange process. The author of each publication who is presently participating in the program is identified by asterisk. Current addresses for all principal investigators are given in the appendix. Author

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N78-25774# Mitre Corp., Bedford, Mass.
DESIGN AND ABSTRACT SPECIFICATION OF A MULTICS SECURITY KERNEL, VOLUME 2
P. T. Withington Mar. 1978 116 p refs
(Contract F19628-77-C-0001)
(AD-A053148; MTR-3294-Vol-2; ESD-TR-77-259-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 15/3

This second volume gives a formal, top-level specification of the primary subsystems of the kernel. The specification is a definition of the input-output behavior of the kernel. It is sufficiently detailed to allow its security, compatibility, and efficiency to be determined. GRA

N78-25775# Mitre Corp., Bedford, Mass.
DESIGN AND ABSTRACT SPECIFICATION OF A MULTICS SECURITY KERNEL, VOLUME 3
J. P. L. Woodward Mar. 1978 51 p refs
(Contract F19628-77-C-0001)
(AD-A053149; MTR-3294-Vol-3; ESD-TR-77-259-Vol-3) Avail: NTIS HC A04/MF A01 CSCL 15/3

On the basis of the recommendations of the Electronic Systems Division Computer Security Technology Panel (1972), the MITRE Corporation developed techniques for the design, implementation, and formal mathematical verification of a

security kernel: a hardware and software mechanism to control access to information within a computer system. This three volume report describes the design of a security kernel for Honeywell Information System's Multics computer system. This third volume gives a formal, top-level specification of the secondary subsystems of the kernel, including the System Security Officer, reconfiguration, and initialization. It is sufficiently detailed to allow its security, compatibility, and efficiency to be determined. The first volume gave a methodology and design overview. The second volume dealt with the primary subsystems of the kernel. Author (GRA)

N78-25776# Sperry Univac, St. Paul, Minn. Defense Systems Div.

RECONFIGURABLE COMPUTER SYSTEM DESIGN FACILITY INITIAL DESIGN STUDY. VOLUME 1: TECHNICAL SUMMARY Final Technical Report, 30 Jun. 1976 - 30 Jul. 1977

D. R. Anderson, L. D. Anderson, and K. Y. Wen Griffiss AFB, N. Y. RADC Jan. 1978 25 p refs 2 Vol.
(Contract F30602-76-C-0355)
(AD-A052995; RADC-TR-78-6-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 09/2

As a method of reducing design and development costs for data processing systems hardware and software a total system design concept is proposed. The concept includes a Reconfigurable System Design Facility RCSDF where total system design alternatives can be emulated for the purpose of evaluating and proving designs prior to actual development. GRA

N78-25777# Sperry Univac, St. Paul, Minn. Defense Systems Div.

RECONFIGURATION COMPUTER SYSTEM DESIGN FACILITY INITIAL DESIGN STUDY. VOLUME 2: TECHNICAL RESULTS Final Technical Report, 30 Jun. 1976 - 30 Jul. 1977

D. R. Anderson, L. D. Anderson, and K. Y. Wen Griffiss AFB, N. Y. RADC Jan. 1978 275 p refs 2 Vol.
(Contract F30602-76-C-0355)
(AD-A053013; RADC-TR-78-6-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 09/2
For abstract, see N78-25776.

N78-25778# Naval Surface Weapons Center, White Oak, Md.

PROGRESS TOWARD THE CROSSTIE MEMORY V Annual Report, Oct. 1976 - 30 Sep. 1977

L. J. Schwee, W. E. Anderson, Y. J. Liu, and R. N. Lee 5 Jan. 1978 46 p
(WF54545602)
(AD-A053288; NSWC/WOL-TR-78-11) Avail: NTIS HC A03/MF A01 CSCL 09/2

This is the fifth annual technical report of progress toward the crosstie memory and it emphasizes work done during the past year. There are four previous reports which can be obtained upon request of the authors of this report. The previous reports present a basis for this report. In the crosstie memory, information is stored, propagated and detected in magnetic domain walls of Permalloy films about 370 A thick. Serrated edges on narrow thin film permalloy strips are used to center a domain wall in each strip and provide stable positions for crossties and Bloch lines. The magnetoresistance effect in the information bearing film is used for detection. The anticipated performance of the crosstie memory includes a shift rate of 20,000,000 bits/sec, a bit density greater than 150,000 bits/sq cm, and operating temperature range from -50 to 100 C, nonvolatility, low cost and low power consumption. Also, the memory can be fabricated on Si or SiO2 and integrated with semiconductor devices. At this time all the necessary functions associated with the shift registers have been demonstrated and shown to be compatible. Present emphasis is being placed on widening the margins of operation so that a reliable and manufacturable device will result. GRA

N78-25779# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

DESIGN OF THE PROCESSOR FOR SOFTWARE COMPATIBLE AVIONIC COMPUTER FAMILY M.S. Thesis

Frederick G. Thourot Dec. 1977 234 p refs
(AD-A053345; AFIT/GCS/EE/77-10) Avail: NTIS HC A11/MF A01 CSCL 09/2

This report presents the design of a microprogrammable processor which emulates the baseline instruction set of the Software-Compatible Avionic Computer Family. The general architecture of this processor includes 16/32 bit word lengths, hardware fixed point arithmetic, firmware floating point arithmetic, and hardware vectored interrupts. The processors uses a flexible internal bus (I-BUS) to interface with memory modules, programmed input/output channels, and DMA channels. Integrated circuit devices from the AM 2900 family are used to realize the design. The processor's arithmetic and logic unit contains four AM 2901A bit slice devices which are cascaded by an AM 2902 carry look-ahead generator. The processor's control unit uses an AM 2910 microsequencer to address control memory in a first level pipeline mode. The processor's hardware vectored interrupt system is managed by two AM 2914 priority interrupt encoders. Evaluation of the processor design determined that the processor's operational speed falls below the design goal of 200 to 500 KOPS. The report concludes with recommendations for improving the processor's speed by adding hardware to facilitate floating point arithmetic and to pipeline I/O transfers over the I-BUS. Author (GRA)

N78-25780# Federal COBOL Compiler Testing Service, Washington, D. C.

FORTRAN COMPILER VALIDATION Summary Report

1978 17 p refs
(AD-A053055; FCVS66-VSR305) Avail: NTIS HC A02/MF A01 CSCL 09/2

The purpose of the Validation Summary Report (VSR) is to identify individual FORTRAN language elements whose implementation does not conform to the language specifications defined in American Standard FORTRAN, X3.9-1966. GRA

N78-25781# University of Southern Calif., Marina del Rey. Information Sciences Inst.

INTERACTIVE COMPILER PROVING USING HOARE PROOF RULES

Donald Scott Lynn Jan. 1978 182 p refs
(Contract DAHC15-72-C-0308; ARPA Order 2223)
(AD-A052911; ISI/RR-78-70) Avail: NTIS HC A09/MF A01 CSCL 09/2

This report demonstrates the proofs by structural induction of two compilers. The larger is a compiler from a subset of pure LISP into a machine language, and is similar to a compiler proved by London. The smaller is the compiler proved by McCarthy and Painter. In addition a portion of another compiler is proved. It is the compiler given by Wirth to compile a simple Pascal-like language (PL/0) into code for a hypothetical stack-oriented machine. We here employ several methods of proof, different from the previous methods, which are amenable to machine-aided proofs. These new methods include the use of Hoare proof rules to describe the semantics of the source and target languages, as well as the language in which the compiler was written, a new formalization of substitution, and axiomatic definition of functions, both in the compiler and in the assertion language. The machine assistance was provided by the Xivus program verification system, which is a later version of the system described by Good, London, and Bledsoe. We believe the methods of compiler proof given here are of general application in the proving of compilers including such source language features as assignment, conditional, repetition, (WHILE), and go to statements, recursive and non-recursive function calls, and statement- or expression-oriented languages. Author (GRA)

N78-25782# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.

ATTRIBUTE PARTITIONING IN A SELF-ADAPTIVE RELATIONAL DATABASE SYSTEM M.S. Thesis

Bahram Niamir Jan. 1978 160 p refs Sponsored by ARPA
(Contracts N00014-75-C-0661; N00014-76-C-0944)
(AD-A053292; MIT/LCS/TR-192) Avail: NTIS HC A08/MF A01 CSCL 05/2

One technique that is sometimes employed to enhance the performance of a database management system is known as attribute partitioning. This is the process of dividing the attributes of a file into subfiles that are stored separately. By storing together those attributes that are frequently requested together by

transactions, and by separating those that are not, attribute partitioning can reduce the number of pages that must be transferred from secondary storage to primary memory in order to process a transaction. The goal of this work is to design mechanisms that can automatically select a near-optimal attribute partition of a file's attributes, based on the usage pattern of the file and on the characteristics of the data in the file. The approach taken to this problem is based on the use of a file design cost estimator and of heuristics to guide a search through the large space of possible partitions. The heuristics propose a small set of promising partitions to submit for detailed analysis. The estimator assigns a figure of merit to any proposed partition that reflects the cost that would be incurred in processing the transactions in the usage pattern if the file were partitioned in the proposed way. We have also conducted an extensive series of experiments with a variety of design heuristics; as a result, we have identified a heuristic that nearly always finds the optimal partition of a file. GRA

N78-25783# Los Alamos Scientific Lab., N. Mex.
SCYLLA IV-P COMPUTER BASED ON CONTROL AND DATA ACQUISITION SYSTEM
R. Conrad, J. W. Lillberg, and R. W. Wilkins 1977 5 p ref Presented at 7th Symp. on Eng. Probl. of Fusion Res., Knoxville, Tenn., 25-28 Oct. 1977
(Contract W-7405-eng-36)
(LA-UR-77-2405; Conf-771029-36) Avail: NTIS HC A02/MF A01

The main computer is a Prime 300 with 64 K words of main storage, two Tektronix 4010 terminals, a Versatec line printer, a card reader, and two 3 M word disks. The control software is also described along with the data acquisition system. ERA

N78-25784# Brookhaven National Lab., Upton, N. Y.
DATA TELECOMMUNICATIONS AT THE CSCF
A. M. Peskin Oct. 1977 23 p refs Presented at Mod Comp User Exchange Meeting, Fort Lauderdale, Fla., 5 Dec. 1977
(Contract EY-76-C-02-0016)
(BNL-23427; Conf-771216-2) Avail: NTIS HC A02/MF A01

Some historical background is presented describing predecessor systems, the development of specifications, and the factors considered in the decision to turn to MODCOMP. The hardware is based around dual MODCOMP II-233 processors with a specially developed link to the large CSCF machines, two Control Data 6600 computers and one CDC 7600. The MODCOMP software is based upon an existing system running under MAXCOM. On the Control Data side Scope 3.4/INTERCOM 4 is used as a basis. The developments and modifications, both hardware and software, necessary for these components to meet Brookhaven's specifications are described. Certain related special purpose data link applications are described. Among them are a research project in national resource sharing networks using ARPANET, and a connection to the National Weather Service machines, using the bit-oriented protocol ADCCP. ERA

N78-25785# California Univ., Livermore. Lawrence Livermore Lab.
CHECKOUT PROCEDURE FOR THE BASIC MCS-8 MICROCOMPUTER LEA74-9001-01
C. W. Jensen 14 Nov. 1977 5 p
(Contract W-7405-eng-48)
(UCID-17658; LER-74-1006-01) Avail: NTIS HC A02/MF A01

The basic mechanical and electrical checkout procedures are detailed for a newly constructed MCS-8 microcomputer. ERA

N78-25786# Sandia Labs., Albuquerque, N. Mex. Model Shops and Inspection Div.
MICROPROCESSOR-BASED DATA ACQUISITION SYSTEM INCORPORATING A FLOATING-POINT ARITHMETIC UNIT FOR COMPLEX MATHEMATICAL COMPUTATIONS
J. Hopwood Feb. 1978 67 p ref
(Contract EY-76-C-04-0789)
(SAND-77-8046) Avail: NTIS HC A04/MF A01

A microprocessor-based, stored-program controller which incorporates a floating-point arithmetic unit to perform complex mathematical computations was developed to determine the thickness of conductors on printed wiring boards. Conductor thickness is calculated from measured resistance by means of curve-fitting equations in the stored program. Called a film thickness calculator, the instrument demonstrates a method which may serve as a basis for other designs involving microprocessor-based data acquisition systems requiring low-speed calculations. ERA

N78-25787# National Technical Information Service, Springfield, Va.
AEROSPACE COMPUTER SYSTEMS. PART 1: AVIONICS APPLICATIONS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - Jan. 1978
William E. Reed Mar. 1978 208 p Supersedes NTIS/PS-77/0126; NTIS/PS-76/0042
(NTIS/PS-78/0289; NTIS/PS-77/0126; NTIS/PS-76/0042)
Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

This updated bibliography contains 203 abstracts of research reports on onboard data processing equipment as well as navigation and guidance computers for aircraft applications. Fifty-two of the abstracts are new entries to the previous edition. Author

N78-25788# National Technical Information Service, Springfield, Va.
AEROSPACE COMPUTER SYSTEMS. PART 2: SPACE AND GUIDED MISSILES APPLICATIONS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - Feb. 1978
George W. Reimherr Mar. 1978 262 p Supersedes NTIS/PS-77/0224; NTIS/PS-76/0043
(NTIS/PS-78/0290; NTIS/PS-77/0224; NTIS/PS-76/0043)
Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

Studies of computer hardware and supporting software for spacecraft and guided missile applications are cited in this updated bibliography which contains 257 abstracts, 140 of which are new entries to the previous edition. Topics covered include on onboard data processing equipment, telemetering data processing, and navigation and guidance computers. Author

N78-25789# National Bureau of Standards, Washington, D. C.
COMPUTER SCIENCE AND TECHNOLOGY: COMPUTER SECURITY AND THE DATA ENCRYPTION STANDARD
Dennis K. Branstad, ed. Feb. 1978 137 p refs Conf. held at Washington, D. C., 15 Feb. 1977
(PB-277695; NBS-SP-500-27; LC-78-1403) Avail: NTIS HC A07/MF A01 CSCL 09B

Technical information and guidance with respect to computer security and the Data Encryption Standard is given. Topics covered include physical security, risk assessment, software security, computer network security, applications, and implementation of the Data Encryption Standard. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N78-25790*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A PARAMETER ESTIMATION SUBROUTINE PACKAGE
G. J. Bierman and M. W. Nead 15 Apr. 1978 144 p refs
(Contract NAS7-100)
(NASA-CR-157165; JPL-Pub-77-26-Rev-1) Avail: NTIS HC A07/MF A01 CSCL 09B

Linear least squares estimation and regression analyses continue to play a major role in orbit determination and related areas. In this report we document a library of FORTRAN subroutines that have been developed to facilitate analyses of a variety of estimation problems. Our purpose is to present an easy to use, multi-purpose set of algorithms that are reasonably efficient and which use a minimal amount of computer storage. Subroutine inputs, outputs, usage and listings are given along with examples of how these routines can be used. The following outline indicates the scope of this report: Section (1) introduction

with reference to background material; Section (2) examples and applications; Section (3) subroutine directory summary; Section (4) the subroutine directory user description with input, output, and usage explained; and Section (5) subroutine FORTRAN listings. The routines are compact and efficient and are far superior to the normal equation and Kalman filter data processing algorithms that are often used for least squares analyses. Author

N78-25791*# Vought Corp., Hampton, Va.
MODIFICATIONS TO THE WDTVOR AND VORTWD COMPUTER PROGRAMS FOR CONVERTING INPUT DATA BETWEEN VORLAX AND WAVE DRAG INPUT FORMATS
Glenn L. Martin Apr. 1978 110 p refs
(Contract NAS1-13500)
(NASA-CR-145360) Avail: NTIS HC A06/MF A01 CSCL 09B

Computer programs, WDTVOR and VORTWD, were developed to convert input data between wave drag and VORLAX input formats. Both programs were modified to include the capability of converting multisegment fuselage data. The capability of converting VORLAX geometric data to wave drag format without camber as well as with camber was added to the VORTWD program. Listings of the original program, the modifications, and the modified program are included for both programs. Author

N78-25792# SRI International Corp., Menlo Park, Calif. Computer Science Lab.
THE RELATIONSHIP OF HDM TO THE NAVY'S SOFTWARE-DEVELOPMENT PROCESS
Lawrence Robinson Mar. 1978 15 p refs
(Contract N00123-76-C-0195; SRI Proj. 4828)
(AD-A052741; SRI-CSL-70) Avail: NTIS HC A02/MF A01 CSCL 09/2

HDM (Hierarchical Development Methodology) is a set of concepts, languages, and on-line tools that is intended to aid in the production of reliable, correct, and maintainable software. This document describes the relationship between HDM and the Navy's software-development process, to illustrate that HDM is consistent with-and can even enhance-the Navy's software-development process. Author (GRA)

N78-25793# Massachusetts Inst. of Tech., Cambridge. Lab for Computer Science.
ACTOR SYSTEMS FOR REAL-TIME COMPUTATION Ph.D. Thesis
Henry G. Baker, Jr. Mar. 1978 149 p refs
(Contract N00014-75-C-0522)
(AD-A053328; MIT/LCS/TR-197) Avail: NTIS HC A07/MF A01 CSCL 09/4

Actor theory was invented by Hewitt and collaborators as a synthesis of many of the ideas from the high-level languages LISP, GEDANKEN, SMALLTALK, SIMULA-67 and others. Actor theory consists of a group of active objects called ACTORS, which communicate by passing messages to one another. This thesis explores several problems associated with implementing Actor theory as a basis for computer system design. First, we give a firmer foundation to the theory by setting forth axioms which must be satisfied by any physically realizable message-passing system. We then give an operational semantics for this theory by exhibiting an interpreter which is a concrete model for the theory. Thirdly, we explore the implementation questions of mapping this conceptual system onto current hardware in such a way that simple primitive operations all take a (small) bounded amount of time. In particular, the issues of storage and processor management are investigated and a real-time incremental garbage system for both is exhibited and analyzed. Author (GRA)

N78-25794# TRW Defense and Space Systems Group, Redondo Beach, Calif.
NSW FEASIBILITY STUDY Final Technical Report
Griffiss AFB, N. Y. RADC Feb. 1978 99 p refs
(Contract F30602-76-C-0270; AF Proj. 5550)
(AD-A052996; RADC-TR-78-23) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report describes work performed to determine the feasibility of using the National Software Works (NSW) to support weapon systems software developments. It contains a discussion of the issues involved in using computer networking resources in support of such projects, and has some suggestions for applying initial NSW capabilities to prototype testbed projects. Appendices contain evaluations of some potential NSW tools, including the JOVIAL Automated Verification System (JAVS) and the On-Line System (NLS), and suggest a configuration management plan for NSW tools. Author (GRA)

N78-25795# Computer Sciences Corp., Arlington, Va.
SOFTWARE PHENOMENOLOGY: WORKING PAPERS OF THE SOFTWARE LIFE CYCLE MANAGEMENT WORKSHOP
Bryce Elkins and Lois Hunt 23 Aug. 1978 683 p refs Workshop held at Airlie House, Warrenton, Va., 21-23 Aug. 1977
(Contract DAHC26-76-D-1006)
(AD-A053014) Avail: NTIS HC A99/MF A01 CSCL 09/2

Software Phenomenology presents the working papers submitted to the Software Life Cycle Management Workshop (August 1977) by the participating authors. The volume also includes an executive summary with recommendations, a summary of the plenary session with chairmen's reports, a list of attendees, and the workshop schedule. The objective of the workshop was to focus upon practical solutions to current software life cycle management problems, emphasizing short- and long-range approaches supported by quantitative studies. Author (GRA)

N78-25796# Decisions and Designs, Inc., McLean, Va.
BENEFIT MODEL FOR HIGH ORDER LANGUAGE
Joseph M. Fox Mar. 1978 40 p
(Contract N00014-76-C-0074; ARPA Order 3052)
(AD-A053032; TR-78-2-72) Avail: NTIS HC A03/MF A01 CSCL 09/2

The purpose of this project was to assess the economic value of DoD standardizing on one software high order language (HOL). Three decision analytic models (i.e. EVAL, SPREAD, and DECISION) were created to make the economic benefit decision for the proposed DoD Common HOL. All models were implemented in APL for the IBM 5100 computer. These models allow a user to start from specific savings values for various language features and derive a year-by-year savings in software expenditures. Implementation of each model is demonstrated. Author (GRA)

N78-25797# System Development Corp., Santa Monica, Calif.
SOFTWARE ACQUISITION MANAGEMENT GUIDEBOOK: SOFTWARE MAINTENANCE Contract Report, Jun. 1976 - Oct. 1976
J. R. Stanfield and Allan M. Skrukrud Oct. 1977 66 p refs
(Contract F19628-76-C-0236)
(AD-A053040; SDC-TM-5772/004/02; ESD-TR-77-327) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report is one of a series of Software Acquisition Management (SAM) guidebooks which provide information and guidance for ESD Program Office personnel who are charged with planning and managing the acquisition of command, control, and communications system software procured under Air Force 800 series regulations and related software acquisition management concepts. The scope of this document is limited to those acquisition and development activities, occurring throughout the SAM cycle, which impact software maintenance. It includes discussions of system turnover to the using command and the transfer of program management responsibility to the supporting command. The computer program life cycle is also considered. Most of the information provided in this report covers the implementing command's responsibilities during the SAM cycle. However, software maintenance during the Deploymnet Phase is also discussed to provide the background for proper planning. Current programming concepts are discussed as well as the military regulations, specifications, and standards. Within these constraints, this report emphasizes what the Program Office can do to specify and procure maintainable software, including procurement of the facilities, support tools, and documentation necessary to support software maintenance activities. Author (GRA)

N78-25798# RAND Corp., Santa Monica, Calif.
RULE-DIRECTED INTERACTIVE TRANSACTION AGENTS: AN APPROACH TO KNOWLEDGE ACQUISITION Interim Report

Donald Arthur Waterman Feb. 1978 61 p refs
(Contracts DAHC15-73-C-0181; MDA903-78-C-0029; ARPA Order 3473)
(AD-A052873; RAND/R-2171-ARPA) Avail: NTIS HC A04/MF A01 CSCL 09/2

A description is presented of computer programs, called user agents, that can perform various tasks for the user. Interacting with users, these agents can learn facts and store them in a data base or learn data-manipulation procedures and represent them as programs. The agents are written in RITA, the Rule-directed Interactive Transaction Agent system, and are organized as sets of IF-THEN rules. Four types of RITA agents are described: (1) an exemplary programming agent that 'watches' a user perform a task, then writes a program to perform the same task; (2) a self-modifying agent that performs file transfer tasks, modifying itself to perform them with less help each time; (3) a tutoring agent that watches demonstrations of interactive computer languages or local operating systems, then creates teaching agents for assisting new users; (4) a reactive-message creating agent that elicits text to create a reactive message, which is then sent to a recipient who interacts with it, automatically returning a response to the sender.

Author (GRA)

N78-25799# Battelle Pacific Northwest Labs., Richland, Wash.
RAFT: A COMPUTER PROGRAM FOR FAULT TREE RISK CALCULATIONS
G. D. Seybold Nov. 1977 67 p refs
(Contract EY-76-C-06-1830)
(BNWL-2146) Avail: NTIS MF A01

RAFT calculated release quantities and a risk measure based on the product of probability and release quantity for cut sets of fault trees modeling the accidental release of radioactive material from a nuclear fuel cycle facility. Cut sets and their probabilities were supplied as input to RAFT from an external fault tree analysis code. Using the total inventory available of radioactive material, along with release fractions for each event in a cut set, the release terms were calculated for each cut set. Each release term was multiplied by the cut set probability to yield the cut set risk measure. RAFT orders the dominant cut sets on the risk measure. ERA

N78-25800# Battelle Pacific Northwest Labs., Richland, Wash.
ACORN: A COMPUTER PROGRAM FOR PLOTTING FAULT TREES
J. L. Carter Nov. 1977 48 p refs
(BNWL-2144) Avail: NTIS HC A03/MF A01

A FORTRAN computer program which analyzes the input logical structure of a fault tree and provides data for CalComp plot of the tree is described. Gates permitted include AND, OR, and INHIBIT, and basic events are drawn as diamonds, circles, or houses. Each component (gate or basic event)can have a descriptive label within a rectangle attached to the top of its respective symbol. Tree logic is input as a set of FORTRAN statements, each defining a gate in terms of logical operations of the components input to it. ACORN develops the logical structure of the tree from the input statements. The tree's physical structure is developed by assigning relative spatial coordinates to the logical realtionships between a gate and its inputs. ACORN provides input data checking, a printer plot of the fault tree, and plotting data for a CalComp model 763 plotter. The program is operational on a CONTROL DATA CYBER 74 computer. ERA

N78-25801# California Univ., Livermore. Lawrence Livermore Lab.
USER'S MANUAL FOR FORTRAN 4 HEMP 3D
S. J. French, Jr. 10 Oct. 1977 18 p ref
(Contract W-7405-eng-48)
(UCRL-52359) Avail: NTIS HC A02/MF A01

A version of the HEMP 3D computer program for solving problems in elastic-plastic flow in three space dimensions and time is presented. User information describing the overall program as well as the source listing is given. The output for two check problems is included. ERA

N78-25802# Brookhaven National Lab., Upton, N. Y. National Center for Analysis of Energy Systems.
INTERACTIVE PLOTTING PACKAGE USING THE 6600 CDC AND DTC 300/S TERMINAL
S. R. Bozzo, F. Galdos, and R. Hakoopian 1977 15 p refs
(Contract EY-76-C-02-0016)
(BNL-22557) Avail: NTIS HC A02/MF A01

This plotting package contains routines found useful for drawing graphs. Written in FORTRAN EXTENDED version 4 as used on a CDC 6600 computer, the interactive package uses a DTC 300/S terminal as the output device. The routines included in the package are PLOT, TEXT1, LINE, and AXIS. ERA

N78-25803# Sandia Labs., Livermore, Calif.
SHELL SHOCK STRUCTURAL CODE, 3RD EDITION
J. E. Grant and V. K. Gabrielson Jan. 1978 123 p refs
(Contract EY-76-C-04-0789)
(SAND-77-8276) Avail: NTIS HC A06/MF A01

SHELL SHOCK is a computer code that performs a frequency analysis and determines the static and dynamic response of any structure represented by mass, damping, and stiffness matrices. These matrices may be formed directly by the user, formed internally by the code from a finite element model, or formed by a combination of the two methods. SHELL SHOCK is primarily intended for analyzing three dimensional axisymmetric structures modeled using structural elements generated by the code in which the spatial coordinates are uncoupled by Fourier harmonics. A three dimensional axisymmetric structure is then reduced to a series of two dimensional problems, which significantly reduce the computations required. Three types of structural elements (that are uncoupled by a Fourier series) are generated internally by the code: linear beams, shells, and solids of revolution. Nonlinear beam elements are also uncoupled and included in the dynamic response computations. ERA

N78-25804# National Technical Information Service, Springfield, Va.
COMPUTER SOFTWARE MAINTENANCE. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - Mar. 1978
George W. Reimherr Apr. 1978 118 p Supersedes NTIS/PS-77/0259; NTIS/PS-76/0322; NTIS/PS-75/355
(NTIS/PS-78/0318; NTIS/PS-77/0259; NTIS/PS-76/0322; NTIS/PS-75/355) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

This updated bibliography contains 113 abstracts. Topics covered include: problems of software maintenance, production, and design; resource allocation; benefit cost analysis; and management planning of computer software maintenance. Design of computer programs is considered for many applications. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N78-25805# Defense Communications Agency, Washington, D.C.
ARPANET INFORMATION BROCHURE
Mar. 1978 30 p
(AD-A052672; AD-E100042) Avail: NTIS HC A03/MF A01 CSCL 17/2

ARPANET is an operational, resource sharing inter-computer network linking a wide variety of computers in CONUS, Hawaii, Norway, and England. Its communications system introduced the revolutionary technique of 'packet switching' where each message is broken up into small packets and each packet is switched to its destination over the quickest communications path available at any given instant. ARPANET was originally designed under a research and development program by the Defense Advanced Research Projects Agency in 1969. Management responsibility of the network was transferred to Defense Communications Agency on July 1, 1975. This brochure provides a general description of the ARPANET and defines the policies and procedures governing its use. Author (GRA)

N78-25806# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A STUDY OF CRITICAL FACTORS IN THE DEVELOPMENT OF AIR FORCE COMPUTERIZED MANAGEMENT INFORMATION SYSTEMS M.S. Thesis

Jere Wayne Retzer Dec. 1977 125 p refs

(AD-A052914; AFIT/GS/SM/77D-28) Avail: NTIS HC A06/MF A01 CSCL 05/1

A number of the factors important to MIS were found to vary with system size, difficulty and contractor involvement. Factor analyses of the sample and two subsets each revealed three factors: user involvement; capabilities of the project organization; and planning and control. Several predictive models were developed for system success, the best of which explained 43% of the variance in success for the total sample, and 52% of the variance in more strongly contracted efforts. It was concluded that six factors are critical to MIS, the three factor analysis factors plus: size and difficulty; criteria for continuing the project; and test time. A process model, consistent with the data, of the initial stages of a MIS was proposed. Author (GRA)

N78-25807# California Univ., Livermore. Lawrence Livermore Lab.

MECHANISMS FOR A RELIABLE TIMER-BASED PROTOCOL

J. G. Fletcher and R. W. Watson 13 Feb. 1978 19 p refs Presented at Computer Network Protocols, Liege, Belgium, 13 Feb. 1978

(Contract W-7405-eng-48)

(UCRL-80425; Conf-780206-1) Avail: NTIS HC A02/MF A01

Timer-based protocol mechanisms are developed for reliable and efficient transmission of both single-message and message-stream traffic; that is, correct data delivery is assured in the face of lost, damaged, duplicate, and out-of-sequence packets. The protocol mechanisms seem particularly useful in a high-speed local network environment. Current reliable protocol design approaches are not well suited for single-message modes of communication appropriate, for example, to distributed network operating systems. The timer intervals that must be maintained for sender and receiver are developed along with the rules for timer operation, packet acceptance, packet creation, and connection opening and closing. The underlying assumptions about network characteristics required for the timer based approach to work correctly are discussed, particularly, that maximum packet lifetime can be bounded. ERA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N78-25808# Speech Communications Research Lab., Inc., Santa Barbara, Calif.

ACOUSTIC/LINGUISTIC ASPECTS OF AUTOMATIC SPEECH RECOGNITION Interim Progress Report, 1 Jan. - 31 Dec. 1977

David J. Broad and Larry L. Pfeifer 3 Mar. 1978 13 p refs (Contract F44620-74-C-0034)

(AD-A052409; AFOSR-78-0692TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report describes: (1) Acquisition of a carefully labeled and segmented data base of connected speech for the testing of segmentation and phonetic identification algorithms. (2) Development and testing against the data base of a segmentation algorithm based on rate of spectral change and rms energy (3) Initiation of a study of inter-speaker vowel-formant scaling based on a 2-dimensional constraint on a speaker's first three formant frequencies. GRA

N78-25809# University of Southern Calif., Los Angeles. Image Processing Inst.

DIGITAL COLOR IMAGE COMPRESSION IN A PERCEPTUAL SPACE

Charles Franklin Hall Feb. 1978 243 p refs

(Contract F33615-77-C-1016)

(AD-A053343; USCIPI-790) Avail: NTIS HC A11/MF A01 CSCL 06/16

Simple mathematical models are developed from the physiological and psychophysical traits of the human visual system. Expressions for the statistical characterization of these models are obtained. When used as a preprocessor, the models are shown to produce images which are statistically compatible with the underlying assumptions necessary to solve the parametric rate distortion equations. The derived power spectrum equations were used to code black and white color images with a quality superior to previous results. In addition, it is shown that the preprocessor produces a 'perceptual space' in which normalized mean square error is an effective image quality measure. Author (GRA)

N78-25810# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

DISCRETE-PATTERN MATCHING ALGORITHMS AND DATA STRUCTURE FOR CYBER 74 M.S. Thesis

John Barton Isett Mar. 1978 102 p refs

(AD-A052916; AFIT/GCS/MA/78M-2) Avail: NTIS HC A06/MF A01 CSCL 09/4

A description of the discrete-pattern matching process is presented with the key elements described. Six data structure approaches and related search algorithms are presented. Twelve programs were coded to implement five out of the six structures/algorithms using packed and unpacked approaches on a CYBER 74. Runs were made with twelve different data files using FORTRAN, English, and random text. The effect of the number of patterns in the data structure and the expected incidence in the text were included. The best data structures/algorithms were a finite state automata and an alternate/successor linked list. Author (GRA)

N78-25811# SRI International Corp., Menlo Park, Calif. Artificial Intelligence Center.

KNOWLEDGE-BASED TECHNIQUES IN ARTIFICIAL INTELLIGENCE Annual Summary Report, Feb. 1977 - Jan. 1978

Nils J. Nilsson 22 Mar. 1978 12 p refs Sponsored by the Navy

(SRI Proj. 6171)

(AD-A053307) Avail: NTIS HC A02/MF A01 CSCL 06/4

This report summarizes the research performed during the first year of a project to investigate knowledge-based techniques in Artificial Intelligence (AI). The objective of this research is to expand the technology of incorporating and using knowledge in computer systems. In developing computer systems for applications in software production, information retrieval, file management, signal identification, photointerpretation, and other data processing problems of interest to the U.S. Navy, it is necessary to provide these systems with large amounts of domain-specific knowledge. Artificial Intelligence research has recently been developing various techniques for incorporating knowledge into computer systems, but as yet it lacks any unifying framework that can be used to coalesce these methods into anything like the engineering discipline that is prerequisite to large-scale practical applications. Because such a unifying framework has not yet been synthesized, each new application effort spends excessive time in developing an individual approach to representing and using knowledge-based systems. Success in the present program will greatly increase the efficiency of future application efforts. GRA

N78-25812# Massachusetts Inst. of Tech., Cambridge. Artifical Intelligence Lab.

THE FRL PRIMER

R. Bruce Roberts and Ira P. Goldstein Jul. 1977 23 p refs (Contract N00014-75-C-0643)

(AD-A053306; AI-M-408) Avail: NTIS HC A02/MF A01 CSCL 06/4

The Frame Representation Language (FRL) is an experimental language written to explore the use of frames as a knowledge representation technique. The term 'frame' as used in FRL was inspired by Minsky's (75) development of frame theory. FLR extends the traditional Property List representation scheme by allowing properties to have comments, defaults and constraints,

to inherit information from abstract forms of the same type, and to have attached procedures triggered by adding or deleting values, or if a value is needed. We introduce FRL with the aid of a simple example: WHOSIS, a database of AI person's names, addresses, interests, and publications. A second section contains an abridged manual describing FRL's most-used commands and conventions. Author (GRA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N78-25813*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

THE DEVELOPMENT OF THE POINCARE-SIMILAR ELEMENTS WITH TRUE ANOMALY AS THE INDEPENDENT VARIABLE

Alan Mueller 30 Sep. 1976 36 p refs

(NASA-TM-79454; JSC-11550; JSC-IN-76-FM-60) Avail: NTIS HC A03/MF A01 CSCL 12A

In reference 1, the Hamiltonian of the unperturbed two-body problem in extended phase space is established. Depending on the type of time transformation, eight canonical elements were developed with the true anomaly or the eccentric anomaly as the independent variable. These two new sets, DS(phi) and DS(u), however contain singularities for small eccentricities and inclinations. In reference 2, these singularities are removed by a transformation from DS(u) to eight canonical PS(u) elements. In reference 3, the DS(phi) variables are transformed to the PS(phi) elements to remove the singularities. However, no direct relation was established between the eight canonical PS(phi) elements and the Cartesian coordinates. It is the purpose of this report to establish those relations and to develop the perturbed equations of motion in the PS(phi) space. This report also demonstrates the accuracy of this new set when it is applied to numerical orbit prediction problems. Author

N78-25814# Battelle Pacific Northwest Labs., Richland, Wash.

SNAKE: A SOLID ANGLE CALCULATION SYSTEM

J. K. Thompson, M. A. Lewallen, and T. J. Trapp Sep. 1977 31 p ref

(Contract AT(45-1)-1830)

(PB-277830; NUREG-CR-0004) Avail: NTIS HC A03/MF A01 CSCL 12A

A computer code, SNAKE (Solid Angle Calculational System For Neutron Interaction And Array K-effective Estimation), was developed for the calculation of solid angles subtended by geometric forms composed of spherical, cylindrical, and planar surfaces, either singularly or in specified arrays, from exact analytic integral forms. This basic capability is used to provide information necessary for the solid angle method for evaluation of neutron interaction in arrays. This document outlines the methodology and use of the code. GRA

N78-25815# Maryland Univ., College Park. Inst. for Physical Science and Technology.

ANALYSIS OF OPTIMAL FINITE ELEMENT MESHES IN R1

I. Babuska and W. C. Rheinboldt Mar. 1978 62 p refs

(Contracts N00014-77-C-0623; E(401)-3443; Grant NSF MCS-72-03721)

(AD-A053026; BN-869) Avail: NTIS HC A04/MF A01 CSCL 12/1

A theory of a posteriori estimates for the finite element method was developed earlier. Based on this theory, for a two-point boundary value problem the existence of a unique optimal mesh distribution is proved and its properties analyzed. This mesh is characterized in terms of certain, easily computable local error indicators which in turn allow for a simple adaptive construction of the mesh and also permit the computation of a very effective a posteriori error bound. While the error estimates are asymptotic in nature, numerical experiments show the results to be excellent already for 10% accuracy. The approaches are not restricted to the model problem considered here only for clarity; in fact, they allow for rather straightforward extensions to more general problems in one dimension as well as to higher order elements. GRA

N78-25816# Maryland Univ., College Park. Computer Science Center.

ON THE RELIABILITY AND OPTIMALITY OF THE FINITE ELEMENT METHOD

Ivo Babuska and Werner C. Rheinboldt Apr. 1978 34 p refs Proposed for Presentation at the Symp. on Future Trends in Computerized Struct. Analysis and Syn., Washington, D. C., 30 Oct. - 1 Nov. 1978

(Contracts N00014-77-C-0623; E(401)-3443; Grant NSF MCS-72-03721)

(AD-A053028; TR-643) Avail: NTIS HC A03/MF A01 CSCL 12/1

An overview is presented of recent theoretical and experimental results on reliable and computationally efficient a posteriori error bounds for finite element solutions. These estimates are composed from error indicators evaluated on the individual elements and these indicators in turn allow for a very effective approach to the effective construction of optimal meshes. Finally, some views are presented about possible future trends in the development of finite element software and an outline is given of the design of an experimental finite element system currently under development. GRA

N78-25817# Stanford Univ., Calif. Systems Optimization Lab.

ON THE SOLUTION OF NONLINEAR EQUATIONS BY PATH METHODS

Thomas R. Elken Oct. 1977 106 p refs

(Contracts N00014-75-C-0267; N00014-75-C-0865; Contract EY-76-03-0326; Grant NSF MCS-76-81259; NSF MCS-76-20019)

(AD-A053200; SU-SOL-77-25) Avail: NTIS HC A06/MF A01 CSCL 12/1

The problem considered is that of finding a solution to a system of nonlinear equations subject to some auxiliary constraints. The methods studied here are called path methods, also referred to as continuation or global Newton methods, for solving equations. A general theory is developed which unifies the results from several papers and allows new methods to be analyzed easily. The new methods are shown to converge under more general boundary and monotonicity conditions than those assumed for the existing methods. A rigorous proof of convergence is given for an algorithm which implements a general path method. Author (GRA)

N78-25818# Naval Research Lab., Washington, D. C.

A SIMPLE MEANS OF UPDATING THE SRIF FILTER WHEN THE STATE EQUATIONS ARE IN TRIANGULAR FORM

Interim Report

Ben H. Cantrell 29 Mar. 1978 15 p refs

(SF12133401)

(AD-A053356; NRL-8212) Avail: NTIS HC A02/MF A01 CSCL 12/1

The square-root information filter (SRIF), which is a numerical method of implementing the Kalman filter, was investigated. Under an important special case of no process noise and an upper triangular form of the state transition matrix the prediction process of the filter is of simple form. The transformed smoothed and predicted states are identical, and the smoothed and predicted covariance factors are related by a simple matrix transform. Author (GRA)

N78-25819# Brookhaven National Lab., Upton, N. Y.

OPTIMAL L INFINITY ESTIMATES FOR SOME GALERKIN METHODS FOR THE DIRICHLET PROBLEM

C. I. Goldstein and R. Scott Aug. 1977 64 p refs

(Contract EY-76-C-02-0016)

(BNL-50711) Avail: NTIS HC A04/MF A01

Optimal L/sup infinity/ error estimates are established for a few different finite element type methods for the Dirichlet problem in a bounded domain. The methods are selected so as to avoid the necessity of imposing boundary conditions on the trial functions, usually difficult in practice. Three specific methods are treated. These are the method of interpolated boundary conditions and two methods of Nitsche. The trial spaces, S/sup

h/, consist of continuous piecewise polynomials of degree less than or equal to K-1 with K greater than 2. ERA

N78-25820# Illinois Univ., Urbana. Dept. of Computer Science.
SEARCH FOR BETTER LINEAR MULTISTEP METHODS FOR STIFF PROBLEMS Ph.D. Thesis
Antony King-Yin Kono Dec. 1977 110 p refs
(Contracts EY-76-S-02-2383)
(COO-2383-0046; UIUCDCS-R-77-899; UILU-ENG-77-1757) Avail: NTIS HC A06/MF A01

For arbitrary k greater than or equal to 1 and alpha contained in the interval (0,pi/2), A (alpha)-stable k-th order k-step formulas exist, so that in an ODE solver alpha can be an extra parameter used to identify among a family of methods of order k the A (alpha)-stable method that should be used for the particular problem. Two measures for assessing the accuracy of k-th order k-step formulas are proposed. The problem of finding the upper bound on the angle of absolute stability for the k-th order k-step formulas having the same accuracy (with respect to one of the measures) is considered. Analytical results are obtained for k = 1, 2, 3, whereas a numerical search is used for the cases when k = 4, 5, 6, 7. ERA

N78-25821# Geological Survey, Denver, Colo. Water Resources Div.
THE USE OF GALERKIN FINITE-ELEMENT METHODS TO SOLVE MASS-TRANSPORT EQUATIONS Final Report
David B. Grove Oct. 1977 61 p refs
(PB-277532; USGS/WRI-49; USGS-WRD-WRI-78-011) Avail: NTIS HC A04/MF A01 CSCL 12A

The partial differential equation that describes the transport and reaction of chemical solutes in porous media was solved using the Galerkin finite element technique. These finite elements were superimposed over finite difference cells used to solve the flow equation. Both convection and flow due to hydraulic dispersion were considered. The technique was applied to a field problem involving an aquifier contaminated with chloride, tritium, and strontium-90. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N78-25822# National Aerospace Lab., Tokyo (Japan). Second Airframe Div.
A NEW PLOTTING METHOD TO ESTIMATE THE POPULATION PARAMETERS OF THE NORMAL DISTRIBUTION
Toshiyuki Shimokawa Nov. 1977 9 p refs
(NAL-TR-464T) Avail: NTIS HC A02/MF A01

Various plotting methods have been proposed to show a sample of finite size drawn from a population on probability paper. Most of them provide cumulative probabilities each of which corresponds to a central tendency, i. e., the mean, median or mode, of the i-th order statistics in a sample of size n or of the cumulative probabilities corresponding to the i-th order statistics. A new plotting method is proposed to estimate the population mean and variance of the normal or the log-normal distribution. A comparison of the population parameters estimated by various plotting methods shows that the proposed plotting method produces excellent estimates. Author

N78-25823# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
COMPUTATION TECHNIQUES FOR LARGE SCALE UNDISCOUNTED MARKOV DECISION PROCESSES
Thom J. Hodgson and Gary J. Koehler Mar. 1978 28 p refs
(Contract N00014-76-C-0096)
(AD-A052895; RR-78-3) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper considers computation techniques associated with the optimization of large scale Markov decision processes. Markov decision processes and successive approximation procedures are described. Then a procedure for scaling continuous time and renewal processes so that they are amenable to the second procedure is discussed. The effect of the scale factor value on the convergence rate of the procedure and insights into proper scale factor selection are given. Finally, various methods of achieving computational efficiency during execution of the optimization are considered. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N78-25824*# Stanford Univ., Calif. Dept. of Civil Engineering.
INFRASTRUCTURE DYNAMICS: A SELECTED BIBLIOGRAPHY
Jarir S. Dajani and Arturo J. Bencosme Jan. 1978 25 p refs
(Grant NsG-2203)
(NASA-CR-152162; SU-IPM-5) Avail: NTIS HC A02/MF A01 CSCL 12B

The term infrastructure is used to denote the set of life support and public service systems which is necessary for the development of growth of human settlements. Included are some basic references in the field of dynamic simulation, as well as a number of relevant applications in the area of infrastructure planning. The intent is to enable the student or researcher to quickly identify such applications to the extent necessary for initiating further work in the field. Author

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

No abstracts in this category.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N78-25825# Ecole Polytechnique Federale, Zurich (Switzerland).
A METHOD OF ISOPERIMETRIC COMPARISON OF THE FUNCTIONALS OF FIELDS IN MATHEMATICAL PHYSICS Ph.D. Thesis [METHODE DE COMPARAISON ISOPERIMETRIQUE DE FONCTIONNELLES DE DOMAINES DE LA PHYSIQUE MATHEMATIQUE]
Marie-Therese Kohler-Jobin 1977 44 p refs In FRENCH; ENGLISH summary
(Thesis-5906) Avail: NTIS HC A03/MF A01

The torsional rigidity and first eigenvalue of a domain can be compared to the same functionals of a circle by imposing the level lines of the first eigenfunction of the fixed membrane problem in the Dirichlet principle for torsional rigidity. A correspondence between the level lines and the concentric circles is determined. Transl. by A.R.H.

N78-25826# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.
LOW TEMPERATURE AND NEUTRON PHYSICS STUDIES Progress Report, Sep. 1976 - Aug. 1976
C. G. Schull Aug. 1977 6 p refs
(Contract EY-76-S-02-3342)
(COO-3342-6) Avail: NTIS HC A02/MF A01

Progress on the rebuilding and reinstallation of neutron spectrometers at the reconstructed MIT Research Reactor is reported. Some of these units were operating on a regular basis since January 1977, and the research program has resumed. Fundamental studies on the operating characteristics of a neutron interferometer system are discussed. Preliminary work on specimen

preparation leading to an extended study of the diamagnetic scattering of neutrons by bismuth is reported. ERA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N78-25827*# Avco Lycoming Div., Stratford, Conn.
YF 102 IN-DUCT COMBUSTOR NOISE MEASUREMENT, VOLUME 1 Final Report, 24 Jul. 1976 - 31 Aug. 1977
Craig A. Wilson Nov. 1977 72 p refs 3 Vol.
(Contract NAS3-20052)
(NASA-CR-135404-Vol-1; LYC-77-56-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 20A

The combustion chamber from a YF 102 gas turbine engine was instrumented with semi-infinite acoustic wave guide probes and installed in a test rig to complement the combustor noise test. These combustor rig tests are described and the recorded data are listed. Internal dynamic pressure level measurements were made at the same locations and at the same operating conditions of the NASA YF 102 test. In addition, the combustor was operated at various off-designed points where one parameter at a time was varied. Background noise recordings were made to determine the magnitude of facility or test rig noise present. Author

N78-25828*# Avco Lycoming Div., Stratford, Conn.
YF 102 IN-DUCT COMBUSTOR NOISE MEASUREMENT, VOLUME 2 Final Report, 24 Jul. 1976 - 31 Aug. 1977
Craig A. Wilson Nov. 1977 193 p 3 Vol.
(Contract NAS3-20052)
(NASA-CR-135404-Vol-2; LYC-77-56-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 20A
For abstract, see N78-25827.

N78-25829*# Avco Lycoming Div., Stratford, Conn.
YF 102 IN-DUCT COMBUSTOR NOISE MEASUREMENT, VOLUME 3 Final Report
Craig A. Wilson Nov. 1977 194 p 3 Vol.
(Contract NAS3-20052)
(NASA-CR-135404-Vol-3; LYC-77-56-Vol-3) Avail: NTIS HC A09/MF A01 CSCL 20A
For abstract, see N78-25827.

N78-25830*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ACOUSTIC MEASUREMENTS OF A LARGE CAVITY IN A WIND TUNNEL
James Scheiman May 1978 36 p refs
(NASA-TM-78658; L-12022) Avail: NTIS HC A03/MF A01 CSCL 20A

Acoustic measurements were made with inside and far-field microphones. Correlation of measured frequencies with available theories indicates that existing theories are applicable over a broader range than previously shown. The cavity configuration with a partial covering downstream amplified tonal intensities. The frequency of the tones depended on cavity size, not on cavity open area. Introducing upstream disturbances decreased the amplitude of the cavity tones. Author

N78-25831*# United Technologies Research Center, East Hartford, Conn.
EXPERIMENTAL ASSESSMENT OF THEORY FOR REFRACTION OF SOUND BY A SHEAR LAYER Final Report
Robert H. Schlinker and Roy K. Amiet Jun. 1978 122 p refs
(Contract NAS1-14973)
(NASA-CR-145359) Avail: NTIS HC A06/MF A01 CSCL 20A

The refraction angle and amplitude changes associated with sound transmission through a circular, open-jet shear layer were studied in a 0.91 m diameter open jet acoustic research tunnel. Free stream Mach number was varied from 0.1 to 0.4. Good agreement between refraction angle correction theory and experiment was obtained over the test Mach number, frequency and angle measurement range for all on-axis acoustic source locations. For off-axis source positions, good agreement was obtained at a source-to-shear layer separation distance greater than the jet radius. Measureable differences between theory and experiment occurred at a source-to-shear layer separation distance less than one jet radius. A shear layer turbulence scattering experiment was conducted at 90 deg to the open jet axis for the same free stream Mach numbers and axial source locations used in the refraction study. Significant discrete tone spectrum broadening and tone amplitude changes were observed at open jet Mach numbers above 0.2 and at acoustic source frequencies greater than 5 kHz. More severe turbulence scattering was observed for downstream source locations. Author

N78-25832*# Massachusetts Inst. of Tech., Cambridge. Fluid Dynamics Research Lab.
THE EFFECT OF TIP VORTEX STRUCTURE ON HELICOPTER NOISE DUE TO BLADE/VORTEX INTERACTION
Thomas L. Wolf and Sheila E. Widnall Mar. 1978 94 p refs
(Grant NsG-2142)
(NASA-CR-152150; MIT-78-2) Avail: NTIS HC A05/MF A01 CSCL 20A

A potential cause of helicopter impulsive noise, commonly called blade slap, is the unsteady lift fluctuation on a rotor blade due to interaction with the vortex trailed from another blade. The relationship between vortex structure and the intensity of the acoustic signal is investigated. The analysis is based on a theoretical model for blade/vortex interaction. Unsteady lift on the blades due to blade/vortex interaction is calculated using linear unsteady aerodynamic theory, and expressions are derived for the directivity, frequency spectrum, and transient signal of the radiated noise. An inviscid rollup model is used to calculate the velocity profile in the trailing vortex from the spanwise distribution of blade tip loading. A few cases of tip loading are investigated, and numerical results are presented for the unsteady lift and acoustic signal due to blade/vortex interaction. The intensity of the acoustic signal is shown to be quite sensitive to changes in tip vortex structure. Author

N78-25833# Michigan Univ., Ann Arbor. Cooley Electronics Lab.
PANOIC77. PART 1: THE PANOIC77 SEQUENCE SIGNAL. PART 2: THE PANOIC77 CONTROLLER AND SIGNAL GENERATOR
T. G. Birdsall, G. E. J. Bold, and K. A. Winick Mar. 1978 85 p
(Contract N00014-75-C-0175)
(AD-A053101; CEL-TR-228; Rept-013376-5-T) Avail: NTIS HC A05/MF A01 CSCL 20/1

PANOIC77 is an exercise, a set of scientific measurements, to be conducted in the Pacific Ocean in July through September 1977, hence the initial P. The participants include (A) ARPA, the Defense Advance Research Projects Agency; (N) Naval Oceanographic Office; (O) Office of Naval Research; (I) Institute for Acoustic Research of Miami, Florida, and (C) Cooley Electronics Laboratory of the Electrical and Computer Engineering Department, The University of Michigan. Cooley is responsible for the signal design, the subject of Part 1 of this report. Part 2 documents the design and operation of the PANOIC77 controller and signal generator. The equipment was designed specifically for the PANOIC77 experiment. It is both a dual signal generator, generating an unmodulated (CW) signal at one frequency and a modulated signal (SEQ) at a different carrier frequency, and a controller that can cycle through specific on/off patterns for these signals. Author (GRA)

N78-25834# Science Applications, Inc., McLean, Va.
[PARABOLIC EQUATION MODEL AND SURFACE SHIP DATA] Final Report
C. W. Spofford 31 Dec. 1977 18 p
(Contract N00039-76-C-0326)
(AD-A052889; SAI-78-710-WA) Avail: NTIS HC A02/MF A01 CSCL 20/1

Partial Contents: Summary of Parabolic Equation Task; Summary of Surface-Ship Source-Level Measurement Task; and Summary of Surtass Technical Support. GRA

N78-25835# National Materials Advisory Board, Washington, D. C.
PROCEEDINGS OF THE WORKSHOP ON ACOUSTIC ATTENUATION MATERIALS SYSTEMS Final Report
1978 152 p refs
(Contract N00014-76-C-1110)
(AD-A053337; NMAB-339) Avail: NTIS HC A08/MF A01 CSCL 11/9

The choice and use of materials for acoustical attenuation is an important technical problem as well as of great interest for improving comfort and working efficiency. Although the major effort in this field is at ambient conditions and in the audio frequency range, there are important applications that involve widely varying pressures, temperatures, and frequencies along with other requirements peculiar to the particular use. Among current problems in the control of acoustic energy are those associated with such diverse applications as ultrasonic devices, space vehicles, and deep-diving oceanographic vehicles. Each of these, of course, may also have other quite different requirements of the acoustical materials in such properties as density, pressure responses, and flammability. GRA

N78-25836# Denver Univ., Colo. Dept of Mathematics.
A SURVEY OF RECENT PROGRESS ON INVERSE PROBLEMS
Norman Bleistein and Jack K. Cohen 21 Jan. 1977 70 p refs
(Contract N00014-76-C-0079; NR Proj. 041-434)
(AD-A052908; MS-R-7806) Avail: NTIS HC A04/MF A01 CSCL 20/1

Over the past few years, the authors have been engaged in a coordinated research program on inverse problems. By this time, the results have been spread over a number of different papers. This review provides an opportunity to collect those results, to filter some of the work that has proven to be of less interest and to incorporate into the presentation new insights that have been developed during this research project. This report describes the three main segments in the research program: physical optics farfield inverse scattering (denoted by the alliteration POFFIS); seismic or subsurface profiling in media with small variations in propagation speed; analysis of the inverse source problem. Author (GRA)

N78-25837# Denver Univ., Colo. Dept. of Mathematics.
A NOTE ON THE INVERSE SOURCE PROBLEM
Norman Bleistein and Jack K. Cohen 15 Dec. 1977 9 p refs
(Contract N00014-76-C-0039; NR Proj. 083-364)
(AD-A052909; MS-R-7807) Avail: NTIS HC A02/MF A01 CSCL 20/1

In an earlier paper, the authors derived a Fredholm integral equation of the first kind for the solution of the inverse source problem for acoustic waves. The eigenvalues of this equation were shown to converge rapidly to zero and also to include zero. Thus, the solution was shown to be non-unique and even the particular part of the solution of that equation was ill-conditioned. In this note it is shown how to obtain the non-trivial information of that integral equation in a well-conditioned manner. Author (GRA)

N78-25838# Hydroacoustics, Inc., Rochester, N.Y.
HVLF-1 CALIBRATION DATA
14 Feb. 1978 43 p refs
(Contract N00039-76-C-0461)
(AD-A053050; HA-105-78) Avail: NTIS HC A03/MF A01 CSCL 17/1

The HVLF-1 acoustic source is incorporated in a tow body. The source includes its own 30 hp hydraulic power supply as well as instrumentation to monitor source level, radiator acceleration (a signal output monitor), sea water temperature, depth, pitch and roll. Additional performance and diagnostic monitoring functions, including supply pressure, oil flow, main stage pressure, first stage pressure, internal pressure, oil temperature, motor temperature, filter condition and leak indicator are also provided. GRA

N78-25839# Science Applications, Inc., McLean, Va.
EXTENSIONS OF THE PARABOLIC EQUATION MODEL FOR HIGH-ANGLE BOTTOM-INTERACTING PATHS
L. B. Dozier and C. W. Spofford 31 Dec. 1977 29 p
(Contract N00039-76-C-0326)
(AD-A052890; SAI-78-712-WA) Avail: NTIS HC A03/MF A01 CSCL 20/1

The specific problem of interest is the propagation of high angles over large distances where the energy is refracted in the ocean-bottom sediments (rather than reflected from a hard interface). The principal difficulty with PE in such geometries is that a steep angle effectively propagates with the period of a shallower angle since the horizontal component of its phase velocity is less than it should be. Hence, the ray period, or cycle distance, is too large. For water-borne paths this problem was largely removed by CMOD. The relaxation of the CMOD convergence-zone constraint permits certain liberties to be taken with the sound-speed profile in the bottom which could not be considered in the water column. GRA

N78-25840# National Technical Information Service, Springfield, Va.
NONLINEAR ACOUSTICS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1966 - Feb. 1978
George W. Reimherr Mar. 1978 141 p Supersedes NTIS/PS-77/0203; NTIS/PS-76/0235; NTIS/PS-75/351; COM-74-10868
(NTIS/PS-78/0240; NTIS/PS-77/0203; NTIS/PS-76/0235; NTIS/PS-75/351; COM-74-10868) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 20A

This updated bibliography contains 135 abstracts, 18 of which are new entries to the previous edition. Topics covered include nonlinear acoustic theory and applications to sound transmission in the atmosphere, underwater, solids, liquids, and gases. Nonlinear relationships are presented for shock tubes, sonar equipment, sonic booms, acoustic defectors, sound generators, acoustic delay lines, porous materials, pipes, ducts, and jet engine noise. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N78-25841# Colorado State Univ., Fort Collins. Dept. of Chemistry.
QUADRATIC JAHN-TELLER COUPLING IN OCTAHEDRAL SYSTEMS
E. R. Bernstein and J. D. Webb Mar. 1978 20 p
(Contract N00014-75-C-1179)
(AD-A052755; TR-20) Avail: NTIS HC A02/MF A01 CSCL 20/10

In this paper Jahn-Teller vibronic coupling calculations are presented for the general case (gamma(8g) x e(g)) in O(h) symmetry. The Hamiltonian employed is complete up to terms quadratic in vibrational coordinates q(theta) and q(epsilon) which span the v(2)(eg) mode of MF6 systems. Calculational details are discussed. It is concluded that, in agreement with previously reported spectroscopic data for ReF6 and IrF6, quadratic terms in the vibronic interaction are essential (both qualitatively and quantitatively) to the complete understanding of intrastate vibronic coupling in transition metal hexafluorides. Author (GRA)

N78-25842# Massachusetts Inst. of Tech., Cambridge.
A STUDY OF THE PION-PROTON REACTION YIELDING DELTA BARYON PLUS RHO MESON, WITH INCOMING PION MOMENTUM OF 5.8 GeL V/C M.S. Thesis
Thomas Francis Ramos Jun. 1977 64 p refs
(AD-A053297) Avail: NTIS HC A04/MF A01 CSCL 20/8

A sample of 2613 events of the type pi(+)p yields pi(+)pi(+)pi(-) were extracted, using the bubble chamber photographs measured by the PEPR (Precision Encoding and Pattern Recognition) point guidance system. The data was reduced using the standard TVGP, SQUAW, and ARROW programs. The sample of four-prong four-constraint events was analyzed under two separate processes, a cluster analysis using the rapidity variable, and a modified Prism Plot analysis using longitudinally Lorentz invariant parameters. Results of the two analyses in obtaining a sample of pi(+)p yields Delta(++)rho(0) events were compared.

Total cross sections for the reactions pi(+ or -)p yields pi(+ or -)pi(+)pi(-) and the partial cross section for the Delta(++)rho(0) channel were given. Comparisons between the Prism Plot data and the predictions of the DarWatts-Weisskopf Absorption Model were made. Spin density matrix elements were calculated and studied. The absorption parameters R(s) and d(s) were determined. Evidence that these absorption radii are not independent of the exchange mechanism is introduced. GRA

N78-25843# Columbia Univ., New York. Dept. of Chemistry.
STRUCTURAL AND DYNAMIC STUDIES OF MATERIALS POSSESSING HIGH ENERGY CONTENT Final Report, 1 Sep. 1973 - 31 Oct. 1977
Nicholas J. Turro 30 Jan. 1978 14 p refs
(Grant AF-AFOSR-2589-74)
(AD-A052936; AFOSR-78-0636TR) Avail: NTIS HC A02/MF A01 CSCL 20/8

The goal of this research is to provide a theoretical and experimental basis for the understanding of the properties of excited molecules and their emission characteristics. A particular emphasis has been directed toward the identification of chemiluminescent systems which might have the highest likelihood of providing a framework for the development of operating chemical lasers which emit in the visible spectral range. The thermal chemistry and photochemistry of dioxetanes and of valence isomers of benzene have been investigated. The chemistry of singlet oxygen is being explored to develop simple and convenient means of producing this species. An important development has been the discovery that the catalytic thermal generation of singlet oxygen from ground state (triplet) oxygen may be feasible. The possibility of using singlet oxygen in developing chemical lasers is also being explored. Finally, the mechanisms of electronic energy transfer and oxidation in polymers are being investigated with the goal of providing a fundamental understanding of these processes that will allow the systematic and rational development of strategies for stabilization of polymer systems. GRA

N78-25844# Stanford Linear Accelerator Center, Calif.
TOTAL CROSS SECTION FOR e(+)e(-) YIELDS HADRONS AND ITS ASSOCIATED SPECTROSCOPY AT SPEAR
H. L. Lynch May 1976 21 p refs Presented at the Internat. Conf. on Production of Particles with new Quantum Numbers, University of Wisconsin, Madison, 22 Apr. 1976
(Contract EY-76-S-03-0326)
(SLAC-PUB-1750; Conf-760473-4) Avail: NTIS HC A02/MF A01

The relation between the cross section for e(+)e(-) yields hadrons and pp yields e(+)e(-) + hadrons is discussed. The structure of these cross sections is described and its implications pointed out. ERA

N78-25845# Stanford Linear Accelerator Center, Calif.
HADRON FINAL STAGES IN DEEP INELASTIC PROCESSES
J. D. Bjorken May 1976 64 p refs
(Contract EY-76-S-03-0326)
(SLAC-Pub-1756) Avail: NTIS HC A04/MF A01

Lectures are presented dealing mainly with the description and discussion of hadron final states in electroproduction, colliding beams, and neutrino reactions from the point of view of the simple parton model. Also the space-time evolution of final states in the parton model is considered. It is found that the picture of space-time evolution of hadron final states in deep inelastic processes isn't totally trivial and that it can be made consistent with the hypotheses of the Parton model. ERA

N78-25846# Indiana Univ., Bloomington. Dept. of Physics.
THEORETICAL PARTICLE PHYSICS Progress Report, 1 Dec. 1976 - 30 Nov. 1977
A. W. Hendry, D. B. Lichtenberg, and D. H. Weingarten Aug. 1977 31 p refs
(Contract EY-76-S-02-2009)
(COO-2009-133) Avail: NTIS HC A03/MF A01

An extensive partial wave analysis of pion-nucleon scattering up to 10 GeV/c was completed revealing many new high spin baryon resonances which correspond to high quark excitations. A one-gluon-exchange potential with linear confinement was examined to study mass spectra, with particular attention being paid to the latest interesting structures around 3.772 GeV at SLAC and 9.5 GeV at FNAL. In gauge fields, success was found in deriving several rigorous results dealing with Wilson's gauge theory on a lattice. ERA

N78-25847# Michigan State Univ., East Lansing.
ELECTRONIC EXCITATION OF COMPOSITE SYSTEMS Final Report, 1 Jul. 1969 - 31 Jul 1977
M. A. El-Bayoumi 1977 19 p refs
(Contract EY-76-S-02-2039)
(COO-2039-33) Avail: NTIS HC A02/MF A01

A single photon time correlation spectrometer was used to study the dynamics of the relaxation processes in excited composite molecular systems in the nanosecond time domain. Topics discussed include: (1) double proton transfer in the the excited states of 7-azaindole hydrogen bounded dimer; (2) rate coefficients for double deuteron transfer reaction at 77 k in 7-azaindole dimer; (3) electron sepctra of several azaindoles in the vapor phase and in several media; (4) formation of an intramolecular triplet excimer in the case of 1,3-diphenylpropane and the rate constant for its formation at 25C in ethanol; (5) intramolecular twisting relaxation following excitation in trans-1,1,4,4-tetraphenyl-2-methylbutadiene (TPMB); (6) anomaly in fluorescence lifetime of naphthylamines; (7) locally excited and intramolecular charge transfer transitions in benzanils; (8) luminescence properties of aromatic amino acids and model compounds; and (9) phosphorescence enhancement in triphenylmethane. ERA

N78-25848# Sandia Labs., Albuquerque, N. Mex.
MAGNETIC HYPERFINE INTERACTION FOR PARTIALLY FILLED SHELLS
E. J. McGuire Nov. 1977 60 p
(Contract EY-76-C-04-0789)
(SAND-77-1431) Avail: NTIS HC A04/MF A01

In most applications of lasers in spectroscopy, and in proposed applications in atomic isotope separation, excited atomic states involving two partially-filled shells are considered. Expressions derived for the hyperfine splitting are sufficiently general that nondiagonal matrix elements can be calculated and their effects evaluated. Electric dipole approximation is used to determine the radiative transition rates. ERA

N78-25849# Georgia Inst. of Tech., Atlanta. School of Nuclear Engineering.
DEVELOPMENT AND APPLICATION OF THE ELECTROCHEMICAL TRACK ETCHING TECHNIQUE Progress Report
G. B. Stillwagon, S. J. Su, and K. Z. Morgan Aug. 1977 46 p refs
(Contract EY-76-S-05-4814)
(TID-28051) Avail: NTIS HC A03/MF A01

Applications of charged particle track amplification in polycarbonate foils by electrochemical etching for fast neutron and alpha particle dosimetry are described. The first results are reported in the effort to use these foils to determine the microdosimetry of Pu-239 in bone. The initial work was involved with calibrating this dosimeter for alpha particle dosimetry; it was calibrated for fast neutron dosimetry already. A device called the vacuum-sealad alpha-calibrator was designed and built for this calibration. Bone samples from dogs with body burdens of Pu-239 (IV) and human bone samples of autopsied material from plutonium workers were tested. The results obtainable using two foil reading techniques are presented. ERA

N78-25850# Missouri Univ., Rolla.
OBSERVATION OF LUMINESCENT SPECTRA IN LOW ENERGY ION-NEUTRAL COLLISIONS Progress Report, 1 Jun. 1976 - 31 May 1978
J. J. Leventhal Jan. 1978 35 p refs
(Contract EY-76-S-02-2718)
(COO-2718-5) Avail: NTIS HC A03/MF A01

Detailed information on the fundamental nature of energy transfer processes in ion-molecule or atom-molecule collisions is given. By combining ion beam techniques with emission spectroscopy, data are obtained which directly lead to internal energy state distributions of atomic and molecular products of

these collisions. Data are in the form of emission spectra from nascent energetically excited species formed in the energy transfer process. Changes in the collision-produced spectra as a function of beam kinetic energy yield information on the extent of energy conversion in the collision process. Some of the specific energy transfer processes studied were applicable to the problem of achieving inverted energy level populations in high pressure gas lasers. Also discussed are experiments designed to test theoretical models which predict product energy partitioning in molecular collisions. ERA

N78-25851# California Univ., Berkeley. Lawrence Berkeley Lab.
SELF-CONSISTENT MODEL CALCULATIONS OF THE ORDERED S-MATRIX AND THE CYLINDER CORRECTION Ph.D. Thesis
J. Millan Nov. 1977 68 p refs Sponsored in part by a Rockefeller Foundation Fellowship
(Contract W-7405-eng-48)
(LBL-7235) Avail: NTIS HC A04/MF A01

The multiperipheral ordered bootstrap is studied by using dual triple Regge couplings exhibiting the required threshold behavior. Self-consistent reggeon couplings and propagators are obtained for values of Regge slopes and intercepts consistent with the physical values for the leading natural-parity Regge trajectories. Cylinder effects on planar pole positions and couplings are calculated. By use of an unsymmetrical planar pi-rho reggeon loop model, self-consistent solutions are obtained for the unnatural-parity mesons. The effects of other Regge poles being neglected, the model gives a value of the pi-eta splitting consistent with experiment. ERA

N78-25852# Oak Ridge National Lab., Tenn.
ANALYSIS OF A NEUTRON SCATTERING AND GAMMA-RAY PRODUCTION INTEGRAL EXPERIMENT ON ALUMINUM FOR NEUTRON ENERGIES FROM 1 TO 15 MeV
S. N. Cramer and E. M. Oblow Jan. 1978 23 p refs Sponsored in part by DNA
(Contract W-7405-eng-26)
(ORNL-TM-6146) Avail: NTIS HC A02/MF A01

Monte Carlo calculations were made to analyze the results of an integral experiment with an aluminum sample to determine the adequacy of ENDF/B-IV neutron scattering and gamma-ray production cross-section data for aluminum. The experimental results analyzed included energy-dependent NE-213 detector neutron and gamma-ray count rates at a scattering angle of 125 deg and pulse-height spectra for scattered neutrons and gamma-rays. The experiments were carried out with the ORELA 1 to 20 MeV pulsed neutron source. The pulse-height data were unfolded to generate secondary neutron and gamma-ray spectra at 125 deg as a function of incident neutron energy. Multigroup Monte Carlo calculations using the MORSE code and ENDF/B-IV cross sections were made to analyze all reported results. Discrepancies between calculated and measured responses were found for secondary neutron scattering data above 10 MeV and for gamma-rays produced at energies between 4 and 7 MeV. ERA

N78-25853# Oak Ridge National Lab., Tenn. Neutron Physics Div.
ANALYSIS OF A NEUTRON SCATTERING AND GAMMA-RAY PRODUCTION INTEGRAL EXPERIMENT ON SILICON DIOXIDE FOR NEUTRON ENERGIES FROM 1 TO 15 MeV
S. N. Cramer and E. M. Oblow Jan. 1978 23 p refs
(Contract W-7405-eng-26)
(ORNL-TM-6145) Avail: NTIS HC A02/MF A01

Monte Carlo calculations were made to analyze the results of an integral experiment with a sample of SiO2 to determine the adequacy of ENDF/B-IV neutron scattering and gamma ray production cross section data for silicon and oxygen. The experimental results analyzed included energy dependent NE-213 detector neutron and gamma ray count rates at a scattering angle of 90 deg and pulse height spectra for scattered neutrons and gamma rays. The experiments were carried out with the ORELA 1 to 20 MeV pulsed neutron source. The pulse height data were unfolded to generate secondary neutron and gamma ray spectra at 90 deg as a function of incident neutron energy. Multigroup Monte Carlo calculations using the MORSE code and ENDF/B-IV cross sections were made to analyze all reported results. No outstanding discrepancies between calculated and measured responses were found on the neutron data below 12 MeV. Possible discrepancies in the inelastic scattering data above 12 MeV are indicated. ERA

N78-25854# Mound Lab., Miamisburg, Ohio.
TRITIUM HALF-LIFE
C. R. Rudy and K. C. Jordan 22 Dec. 1977 13 p refs
(Contract EY-76-C-04-0053)
(MLM-2458) Avail: NTIS HC A02/MF A01

Least squares analyses of calorimetric measurements made on two tritide compounds over a period of 18 years were performed to determine the half-life of tritium. A half-life of 12.3232 + or - 0.0043 means solar years was obtained. ERA

N78-25855# California Univ., Livermore. Lawrence Livermore Lab.
NEUTRON-INDUCED ANGULAR AND ENERGY DISTRIBUTIONS: GRAPHICAL EXPERIMENTAL DATA
D. E. Cullen, R. J. Howerton, M. H. MacGregor, and S. T. Perkins 1 Apr. 1977 18 p refs
(Contract W-7405-eng-48)
(UCRL-50400-Vol-19) Avail: NTIS HC A02/MF A01

Graphs of neutron-induced distributions were generated, using data found in the Experimental Cross Section Information Library as of April 1, 1977. Angular and energy distributions as well as Legendre coefficients are presented for all secondary particles emitted from the nucleus (e.g., neutrons, protons, deuterons, etc.). The data plotted with error bars when they have been available. ERA

N78-25856# California Univ., Berkeley. Lawrence Berkeley Lab.
ORDERED S-MATRIX APPROACH TO THE TOPOLOGICAL EXPANSION FOR BARYONS AND MESONS
Henry P. Stapp 16 Aug. 1977 90 p refs
(Contract W-7405-eng-48)
(LBL-6735) Avail: NTIS HC A05/MF A01

The extension of order Hilbert space approach to the topological expansion of processes involving baryons is discussed. The proposal is based on a topological classification scheme for baryonic processes that is similar to one used previously for the lowest-order contributions, but is in terms of the minimum number of reggeon closed loops instead of handles. ERA

N78-25857# Stanford Linear Accelerator Center, Calif.
JET PRODUCTION AND THE DYNAMICAL ROLE OF COLOR
S. J. Brodsky May 1977 22 p refs Presented at the 12th Rencontre de Moriond, Flaine, France, 6-18 Mar. 1977
(Contract EY-76-S-03-0376)
(SLAC-PUB-1937; Conf-770319-8) Avail: NTIS HC A02/MF A01

The possibility of distingushing multiparticle jets which originate from quarks, multiquarks, hadrons or gluons by their quantum number retention, leading particle distributions, and hadronic multiplicity is discussed. The possible quantitative connection between initial color separation and hadron multiplicity is emphasized. Evidence for wee quark exchange as a dominant hadronic mechanism is presented. Several mechanisms for gluon jet production are explored as well as the possibility of utilizing a high multiplicity trigger to expose gluon exchange and production contributions in hadron and lepton-induced reactions. ERA

N78-25858# Stanford Linear Accelerator Center, Calif.
LEPTONS AS A PROBE OF HADRONIC STRUCTURE
Frederick J. Gilman Apr. 1976 46 p refs Presented at the Summer Inst. on Particle Phys., Stanford, Calif., 21 Jul. 1975
(Contract EY-76-S-03-0326)
(SLAC-PUB-1732; Conf-750754-5) Avail: NTIS HC A03/MF A01

Lectures are given on some of the theoretical ideas involved in electroproduction, neutrino production and electron-positron annihilation into hadrons. In so doing a study is simultaneously made of both the short distance behavior of products of currents and hadron structure. ERA

N78-25859# California Univ., Riverside.
SEARCH FOR CHARMED PARTICLE PRODUCTION IN PROTON-PROTON COLLISIONS AT THE CERN-ISR Ph.D. Thesis
William Leigh Marsh Jun. 1977 145 p refs
(Contract EY-76-S-03-0326-107)
(TID-28036) Avail: NTIS HC A07/MF A01

Experimental results on a search for charmed particle production in proton-proton collisions at the center of mass energy of 53 GeV are presented. A search was made for evidence of electron-strange particle coincidences, a signature of charmed particle production. The inclusive e/pi ratio was measured with a magnetic spectrometer located at 32 degs from Beam 1 of Intersection 16 of the CERN Intersection Storage Rings (ISR). To determine if there is an electron-strange particle correlation, the number of lambda superscript o s (kappa superscript o s) in coincidence with an electron in the 32 deg spectrometer was compared with the number of lambda s (kappa superscript o s) in coincidence with a hadron in the same kinematic range. No evidence for an enhanced prouduction of strange particles with electrons relative to hadrons was found. However, given the acceptance of the apparatus, the absence of a signal is consistent with current models of charmed particle production and decay.
ERA

N78-25860# Argonne National Lab., Ill.
RECENT RESULTS ON POLARIZATION PHENOMENA
H. Spinka 1977 29 p refs Presented at the Ann. Particles and Fields Meeting, Argonne, Ill., 6-8 Nov. 1977
(Contract W-31-109-eng-38)
(ANL-HEP-CP-77-80; Conf-771089-2) Avail: NTIS HC A03/MF A01

The topics relating to polarization phenomena discussed include the structure in certain pp spin observables with new results also presented and possibly indicating the existence of a dibaryon resonance, inclusive proton polarization, and pp elastic scattering at high energy. Some general features of the data are discussed.
ERA

N78-25861# Georgia Inst. of Tech., Atlanta. School of Nuclear Engineering.
NEUTRON DOSIMETRY USING ELECTROCHEMICAL ETCHING
Shian-Jang Su, Gary B. Stillwagon, and Karl Z. Morgan 1977 12 p refs Presented at the 22d Ann. Meeting of the Health Phys. Soc., Atlanta, 3-8 Jul. 1977
(Contract EY-76-S-05-4814)
(CONF-770720-9) Avail: NTIS HC A02/MF A01

Alpha - Alpha tracks and fast-neutron-induced recoils tracks were amplified by the electrochemical etching technique and the etching results compared with a conventional etching technique were the electrochemically etched tracks were of much larger diameter and gave superior contrast. A Poisson distribution was determined for the number of tracks located in a particular area of the foil and experimentally verified by random counting of quarter sections of the microfiche reader screen. Finally, in an effort to determine dose equivalent (rem), a conversion factor is being determined by finding the sensitivity response (tracks/neutron) of recoil particle induced tracks as a function of monoenergetic fast neutrons and comparing results with those obtained by others.
ERA

N78-25862# Tennessee Valley Authority, Knoxville.
SPUTTERING CALCULATIONS WITH THE DISCRETE ORDINATED METHOD
T. J. Hoffman, H. L. Dodds, Jr., M. T. Robinson, and D. K. Holmes 29 Nov. 1977 33 p refs Presented at the ANS Winter Meeting, San Francisco, 27 Nov. 1977
(Contract W-7405-eng-26)
(CONF-771109-60) Avail: NTIS HC A03/MF A01

The applicability was investigated of the discrete ordinates (S/sub N/) method to light ion sputtering problems. In particular, the neutral particle discrete ordinates computer code ANISN, was used to calculate sputtering yields. No modifications to this code were necessary to treat charged particle transport. However, a cross section processing code was written for the generation of multigroup cross sections; these cross sections include a modification to the total macroscopic cross section to account for electronic interactions and small-scattering-angle elastic interactions. The discrete ordinates approach enables calculation of the sputtering yield as functions of incident energy and angle and of many related quantities such as ion reflection coefficients, angular and energy distributions of sputtering particles, the behavior of beams penetrating thin foils, etc. The results of several sputtering problems as calculated with ANISN are presented.
ERA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N78-25863# Argonne National Lab., Ill.
EULERIAN ALGORITHM FOR ANALYZING FLUID-STRUCTURE INTERACTION IN THE FAST REACTOR CONTAINMENT
C. Y. Wang, Y. W. Chang, and S. H. Fistedis 1977 18 p refs Presented at 4th Intern. Conf. on Structural Mech. in Reactor Technol., San Francisco, 15-19 Aug. 1977
(Contract W-31-109-ENG-38)
(CONF-770807-54) Avail: NTIS HC A02/MF A01

A Eulerian algorithm is capable of analyzing two-dimensionally the fluid-structure interaction in a typical light metal fast breeder reactor containment consisting of various structure components. The algorithm has several special features: (1) it employs the Eulerian coordinates in the formulation and enables the technique to be applicable to excursions involving large material distortions; (2) it provides rigorous hydrodynamic analyses at the fluid-structure interface and at the geometrical discontinuities, which are very important in the study of wave-transmission and -diffraction problems; and (3) the algorithm incorporates a well-developed finite-element structural program that can account for both material and geometrical nonlinearities. The application of this Eulerian algorithm is not limited to fast reactor containment. It can also be applied to the major piping components, such as valve and IHX, where internal baffle plates may play an important role in the wave propagation.
ERA

N78-25864# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
DEVELOPMENT AND APPLICATION OF THE PLANS COMPUTER PROGRAM FOR ANALYSIS OF NUCLEAR REACTOR STRUCTURAL COMPONENTS
A. Levy, A. Pifko, and H. Armen, Jr. Jun. 1977 65 p refs
(Contract W-7405-eng-26-4485)
(ORNL-Sub-4485-1; RE-542) Avail: NTIS HC A04/MF A01

A group of finite element computer programs (PLANS) for the nonlinear analysis of complex structures is described. Modules of the PLANS group described are: (1) BEND, for the elastic-plastic analysis of the built-up structures where bending and membrane effects are significant, (2) HEX, for the three dimensional elastic plastic analysis of general solids, (3) REVBY, for the elastic-plastic analysis of axisymmetry loaded bodies of revolution; and (4) OUT-OF-PLANE-GM, for the elastic plastic and geometric nonlinear analysis of built-up sheetstringer type structures. The capabilities and present status of these modules are summarized. The initial strain concept issued within an incremental procedure to account for the effect of plasticity and the capability for cyclic analysis is included. Geometric nonlinearities are included in OUT-OF-PLANE-GM using the updated or convected coordinate approach.
ERA

N78-25865# Brookhaven National Lab., Upton, N. Y. Information Analysis Center.
SOURCE LIST OF NUCLEAR DATA BIBLIOGRAPHIES, COMPILATIONS, AND EVALUATIONS
T. W. Burrows and N. E. Holden Aug. 1977 68 p
(Contract EY-76-C-02-0016)
(BNL-NCS-50702) Avail: NTIS HC A04/MF A01

Nuclear data bibliographies, compilations, and evaluations

are listed including their availability and cost as well as cross referencing and classification. ERA

N78-25866# Brookhaven National Lab., Upton, N. Y.
INTERACTION OF PIONS AND KAONS WITH NUCLEONS AND NUCLEI
Carl B. Dover 1977 26 p Presented at Journees d'Etudes Saturne, Aussois, France, 3-7 Oct. 1977
(Contract EY-76-C-02-0016)
(BNL-23351; Conf-771090-1) Avail: NTIS HC A03/MF A01

A brief outline of hadronic reactions is given with emphasis on interactions of pions and K (+-) with nucleons and nuclei. Primary consideration is given to energies less than 800 MeV. ERA

N78-25867# California Univ., Livermore. Lawrence Livermore Lab.
NEUTRAL BEAM REQUIREMENTS FOR MIRROR REACTORS
Ralph W. Moir 1 Dec. 1977 25 p Presented at Plasma Heating Develop. Requirements Workshop, Gaithersburg, Md., 5-7 Dec. 1977 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-80408; Conf-771213-4) Avail: NTIS MF A01

The neutral beam requirements for mirror reactors as presently envisioned are 200 keV for the Field Reversed Mirror (FRM) and 1200 keV for the Tandem Mirror (TMR). The hybrid version of the Standard Mirror, FRM and TMR require 100 to 120 keV. Due to the energy dependence of atomic processes, negative ions should produce neutrals more efficiently than positive ions above some energy and below this energy, positive ions are probably more efficient. Thus, we conclude that hybrid reactors can use D ions but all of the fusion reactor designs call for D-ions to make the neutral beams. Trends in the energy requirements are discussed. The hardening of neutral beams against neutron and gamma radiation is discussed. ERA

N78-25868# California Univ., Livermore. Lawrence Livermore Lab.
MIRROR HYBRID (FUSION-FISSION) REACTOR
D. J. Bender, J. D. Lee, W. S. Neef, R. S. Devoto, T. R. Galloway, J. H. Fink, K. R. Schultz, D. Culver, and S. Rao Oct. 1977 17 p refs Presented at IAEA Conf. and Workshop on Fusion Reactor Design, Madison, Wis., 12 Oct. 1977
(Contract W-7405-eng-48)
(UCRL-80076; Conf-771056-9) Avail: NTIS HC A02/MF A01

The reference mirror hybrid reactor design is summarized. The reactor parameters were to minimize the cost of producing fissile fuel for consumption in fission power reactors. Existing technology was used wherever possible. The resulting reactor may thus be viewed as a comparatively near-term goal of the fusion program, improved performance for the hybrid in the future is projected as more advanced technology becomes available. ERA

N78-25869# California Univ., Livermore. Lawrence Livermore Lab.
PROBLEMS WITH rho R MEASUREMENTS: WHAT ARE THE WAYS OUT?
Y. L. Pan and J. T. Larsen 25 Oct. 1977 44 p refs Presented at Ann. Am. Physical Soc. Meeting, Atlanta Ga., 7 Nov. 1977
(Contract W-7405-eng-48)
(UCRL-79772; Conf-771136-8) Avail: NTIS HC A03/MF A01

An important scaling parameter or figure of merit in inertially-confined fusion is the maximum fuel rho R achieved by the target - rho is the density, and R the radius of the fuel. Every technique used, thus far, in laser-initiated-fusion-microexplosion experiments to obtain this data has major deficiencies. The merits of the various possible methods of measuring fuel rho R and their ranges of applicability are examined. ERA

N78-25870# Addis Translations International, Portola Valley, Calif.
EVALUATION OF THE SAFETY OF STORING RADIOACTIVE WASTES IN GEOLOGICAL FORMATIONS: A PRELIMINARY APPLICATION OF THE FAULT TREE ANALYSIS TO SALT FORMATIONS
G. Bertozzi, M. DAlessandro, F. Girardi, and M. Vanossi 24 Oct. 1977 23 p Transl. into ENGLISH from French Report Presented at Workshop on Risk Analysis and Geol. Modelling, Ispra, Italy, 23 May 1977
(BNWL-tr-272; Conf-770565-2) Avail: NTIS HC A02/MF A01

Two imaginary formations were selected: salt bed and salt dome. Hypotheses on their stratigraphic, hydrologic, and geomorphologic conditions were made. Fault tree analysis was used on the various groups of phenomena which could cause the geological barrier to fail. The types of failures and their probabilities were evaluated on the basis of four time periods (103, 104, 105, 106 years). ERA

N78-25871# General Electric Co., Schenectady, N. Y.
ADVANCED GAS COOLED NUCLEAR REACTOR MATERIALS EVALUATION AND DEVELOPMENT PROGRAM
1977 50 p
(Contract EY-76-C-02-2975)
(COO-2975-10) Avail: NTIS HC A03/MF A01

Results of work performed on the Advanced Gas Cooled Nuclear Reactor Materials Evaluation and Development Program are presented. The objectives of this program are to evaluate candidate alloys for Very High Temperature Reactor (VHTR) Process Heat and Direct Cycle Helium Turbine (DCHT) applications, in terms of the effect of simulated reactor primary coolant (impure Helium), high tempeatures, and long time exposures, on the mechanical properties and structural and surface stability of selected candidate alloys. A second objective is to select and recommend materials for future test facilities and more extensive qualification programs. Work covered in this report includes progress to date on alloy selection for VHTR Nuclear Process Heat (NPH) applications and for DCHT applications. The present satatus on the stimulated reactor helium loop design and on designs for the testing and analysis facilities and equipment is discussed. ERA

N78-25872# Addis Translations International, Portola Valley, Calif.
GLASS AS THE FIRST BARRIER FOR LONG-TERM STORAGE OF HIGHLY ACTIVE RADIOACTIVE WASTES
F. Laude 24 Oct. 1977 34 p refs Transl. into ENGLISH of "Le Verre Comme Premiere Barriere pour Le Stockage a Long Terme des Dechets de Haute Activite" French Report, 1977 p 50-77 Presented at the Workshop on Risk Analysis and Geol. Modelling, Ispra, Italy, 23-27 May 1977 Sponsored by DOE Prepared for Battelle Pacific Northwest Labs., Ohio
(BNWL-TR-274; Conf-770565-4) Avail: NTIS HC A03/MF A01

The glasses are of siliceous composition, and ought to have adequate properties of nuclear, chemical, and thermal stability. After a period of artificial storage at the surface to allow cooling, the glass blocks are normally buried in an appropriate geological site, where decay will be completed. To be able to evaluate the risks that activity will spread in the environment as soon as these blocks are buried, it is of paramount importance to know the characteristics of these glasses as well as the influence of time on their main properties. The main results are presented separately depending on whether the glasses contain actinides or not. ERA

N78-25873# Sandia Labs., Albuquerque, N. Mex. Geologic Projects Div.
ESTIMATES OF RELATIVE AREAS FOR THE DISPOSAL IN BEDDED SALT OF LWR WASTES FROM ALTERNATIVE FUEL CYCLES
R. C. Lincoln, David W. Larson, and Carl E. Sisson Jan. 1978 240 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1816) Avail: NTIS HC A11/MF A01

Land use requirements for the disposal of light-water reactor radioactive wastes in a hypothetical bedded-salt formation are estimated. Five waste types from alternative fuel cycles were considered. The relative thermal response of each of five different site conditions to each waste type were determined. The fuel cycles considered are the once-through (no recycle), the

uranium-only recycle, and the uranium and plutonium recycle. Waste types which were considered include: (1) unreprocessed spent reactor fuel; (2) solidified waste derived from reprocessing uranium oxide fuel; (3) plutonium recovered from reprocessing spent reactor fuel and doped with 1.5% of the accompanying waste from reprocessing uranium oxide fuel; (4) waste derived from reprocessing mixed uranium/plutonium oxide fuel in the third recycle; and (5) unreprocessed spent fuel after three recycles of mixed uranium/plutonium oxide fuels. The relative waste-disposal areas were determined from a calculated value of maximum thermal energy content of the geologic formations. ERA

N78-25874# NUS Corp., Rockville, Md.
GENERIC DESCRIPTION OF RADIOLOGICAL AND METEOROLOGICAL MONITORING PROGRAM FOR FEDERAL REPOSITORIES FOR RADIACTIVE WASTES
Sep. 1977 94 p refs Sponsored in part by Union Carbide, New York
(Contract W-7405-eng-26)
(Y/OWI/SUB-42502) Avail: NTIS HC A05/MF A01

Terminal facility concepts are being developed that will use subsurface locations in specially selected geological formations to isolate commercial radioactive wastes. It is anticipated that regulatory authorities will require some form of monitoring as confirmation of isolation and that public health and safety are being assured. A limited study is presented of two components (radiological, meteorological) of environmental monitoring programs for surface nuclear facilities as they might be applied to a geological waste terminal repository. ERA

N78-25875# Envirosphere Co., N. Y.
REVIEW OF PROPOSED FORMATS FOR SAFETY ANALYSIS REPORTS FOR RADIOACTIVE WASTE REPOSITORIES IN DEEP GEOLOGIC FORMATIONS Final Report
Sep. 1977 32 p refs
(Contract W-7405-eng-26)
(Y/OWI/SUB-77/45706) Avail: NTIS HC A03/MF A01

Two proposed Safety Analysis Report (SAR) format outlines for submission to the Nuclear Regulatory Commission for approval of federal repositories for terminal storage of radioactive wastes were reviewed and comments developed in light of past nuclear licensing experiences and current Regulatory Guides. It was concluded that an SAR format and content guide can be developed within the fundamental framework of Regulatory Guide 3.26 by the incorporation of some additional salient features. Further revision and/or development are needed for Site Characteristics, Facility Description, and Process Systems. Close coordination of the parallel activities contained in the proposed SAR development schedule will be required. Two additional SAR support effects are recommended. ERA

N78-25876# Los Alamos Scientific Lab., N. Mex.
TRANSPORT AND REACTOR THEORY Progress Report, 1 Jul. - 30 Sep. 1977
W. F. Miller, Jr., comp., D. J. Dudziak, comp., R. D. ODell, comp., and M. F. Gomez, comp. Nov. 1977 44 p refs
(Contract W-7405-eng-36)
(LA-7025-PR) Avail: NTIS HC A03/MF A01

Progress is summarized in the areas of transport codes and methods, code support and standards, and fusion reactor nucleonics. ERA

N78-25877# Hanford Engineering Development Lab., Richland, Wash.
TRENDS IN THEORETICAL CALCULATION OF DOSIMETRY AND GAS PRODUCTION CROSS SECTIONS FOR FBR'S, LWR'S AND MFE'S
F. M. Mann and R. E. Schenter 1977 11 p Presented at 2d ASTM-EURATOM Symp. on Reactor Dosimetry Methods for Fuels, Cladding and Structural Mat., Palo Alto, Calif., 2 Oct. 1977
(Contract EY-76-C-14-2170)
(HEDL-SA-1269; Conf-771036-8) Avail: NTIS HC A02/MF A01

The energy ranges of prime interest for Light Water Reactors (LWR's), Fast Breeder Reactors (FBR's), and Magnetic Fusion Energy Devices (MFE's) are quite different, the low eV region for LWR's, the keV region for FBR's, and around 14 MeV for MFE's. Yet although the energy range is wide, the statistical model of nuclear reactions works well for most of the dosimetry and gas production needs. Even at 15 MeV where the predictions of the model are compared against experiments, the model works well. ERA

N78-25878# Oak Ridge National Lab., Tenn. Engineering Technology Div.
HIGH-TEMPERATURE STRUCTURAL DESIGN PROGRAM Semiannual Progress Report, period ending 31 Dec. 1976
J. M. Corum and C. E. Pugh Nov. 1977 236 p refs
(Contract W-7405-eng-26)
(ORNL-5281) Avail: NTIS HC A11/MF A01

Progress in the development of high-temperature structural design methods for LMFBR components is reported under the following headings: constitutive equation development; inelastic structural tests and analyses; design criteria and rules for time-dependent deformation and failure; simplified design methods; thermal ratchetting tests; and structural design methods for weldments. ERA

N78-25879# Westinghouse Hanford Co., Richland, Wash.
OVERVIEW OF GAMMA-RAY ENERGY DEPOSITION AND SPECTRA IN FAST REACTOR ENVIRONMENTS
R. Gold 1977 52 p refs Presented at the 2d ASTM-EURATOM Sym. on Reactor Dosimetry Methods for Fuels, Cladding and Structural Mater., Palo Alto, Calif., 2 Oct. 1977
(Contract EY-76-C-14-2170)
(HEDL-SA-1238; Conf-771036-7) Avail: NTIS HC A04/MF A01

Efforts to define gamma ray heating in breeder reactor environments are reviewed. Future needs are also addressed in terms of requirements for the Fast Flux Test Facility. Experimental efforts and theoretical analyses are surveyed for both high and low power environments. Special emphasis is placed on experimental techniques for calorimetry, temperature measurement, dosimetry and spectrometry. The relation between neutron and gamma ray calculation is stressed with particular attention given to contrasting analytical techniques and basic nuclear data requirements. Wherever possible comparisons between theory and experiment are cited. ERA

N78-25880# Atomics International Div., Richland, Wash. Rockwell Hanford Operations.
GEO-ENGINEERING REVIEW AND PROPOSED PROGRAM OUTLINE FOR THE STRUCTURAL DESIGN OF A RADIOACTIVE WASTE REPOSITORY IN COLUMBIA PLATEAU BASALTS
J. F. P. Agapito, M. P. Hardy, and D. R. StLaurent Sep. 1977 98 p refs
(Contract EY-77-C-06-1030)
(RHO-ST-6) Avail: NTIS HC A05/MF A01

Deep underground storage of radioactive waste in basalt formations of the Columbia Plateau is considered. Thermal and mechanical properites of basalt were reviewed. The results of this review show that basalt has many characteristics favorable to long-term storage, including strength and thermal stability indicating the ability to isolate the waste from the biosphere in a geologically stable environment. The available computer codes which may be used to simulate the thermo-mechanical behavior of the rock mass surrounding the repository were reviewed and evaluated. There are several codes currently available or under development that can analyze geo-engineering problems and model the repository in order to predict rock mass behavior. ERA

N78-25881# Atomics International Div., Golden, Colo. Rocky Flats Plant.
WASTE INCINERATION AND FIXATION FOR WASTE MANAGEMENT, PRODUCTION, AND REPROCESSING DIVISION OF THE DEPARTMENT OF ENERGY Status Report, Jul. - Dec. 1976
Donald L. Ziegler, Jim W. White, Andrew J. Johnson, Leong Q. Fong, Alton R. Teter, and Seng F. Chung 25 Nov. 1977 25 p refs
(Contract EY-76-C-04-3533)
(RFP-2655) Avail: NTIS HC A02/MF A01

Fluidized bed incineration and waste fixation processes used

to process the types of wastes expected from nuclear fuel reprocessing and production plant are discussed. Test incineration runs were made on two types of wastes; high efficiency particulate air (HEPA) filters and tributyl phosphate-solvent solutions. Laboratory-scale vitirification equipment was used to produce glass pellets from incinerator ash and blends of other expected waste streams. Computer modeling gave an expected product integrity life of over 2,000 years. ERA

N78-25882# Union Carbide Corp., Oak Ridge, Tenn. Office of Waste Isolation.
GEOLOGICAL CRITERIA FOR RADIOACTIVE WASTE REPOSITORIES
G. D. Brunton and W. C. McClain 28 Nov. 1977 19 p refs
(Contract W-7405-eng-26)
(Y/OWI/TM-47) Avail: NTIS HC A02/MF A01

The isolation of radioactive waste in a geological rock unit requires careful evaluation to determine if radionuclides from the emplaced waste will eventually appear in the biosphere in amounts that would constitute a hazard. A comprehensive list of geological criteria and factors is provided that can be used to derive the specifications that will be applied to each step of a geological evaluation process. Engineering and socioeconomic criteria that are influenced by geological factors are included. ERA

N78-25883# Union Carbide Corp., Oak Ridge, Tenn. Office of Waste Isolation.
SELECTED CHARTS: NATIONAL WASTE TERMINAL STORAGE PROGRAM
21 Oct. 1977 33 p refs
(Contract W-7405-eng-26)
(Y/OWI/TM-46) Avail: NTIS HC A03/MF A01

The status of the Office of Waste Management (OWI) Waste Management Program was reviewed. Copies of the viewgraphs and 35 mm slides shown at the briefing are compiled. Author (ERA)

N78-25884# Los Alamos Scientific Lab., N. Mex.
GNASH: A PREEQUILIBRIUM, STATISTICAL NUCLEAR MODEL CODE FOR CALCULATION OF CROSS SECTIONS AND EMISSION SPECTRA
P. G. Young and E. D. Arthur Nov. 1977 108 p refs
(Contract W-7405-eng-36)
(LA-6947) Avail: NTIS HC A06/MF A01

A multistep Hauser--Feshbach code that includes corrections for preequilibrium effects is described. The code can calculate up to 60 decay reactions (cross sections and energy spectra) in one computation, and thereby provide considerable flexibility for handling processes with complicated reaction chains. Input parameter setup, problem output, and subroutine descriptions are given along with a sample problem calculation. A brief theoretical description is also included. ERA

N78-25885# Princeton Univ., N. J.
NUCLEAR CHEMISTRY Progress Report
1977 35 p
(Contract EY-76-S-02-2184)
(COO-2184-45) Avail: NTIS HC A03/MF A01

Results on the Coulomb capture of negative muons by the binary alloy systems Cu/Al and Ag/Zn show that (within experimental error) there is no change in the per atom negative muon capture probability when the atomic ratio in these alloys varies over a range of approximately 40. The K muonic X-ray intensity pattern observed from muon capture in atmospheric N2 was strikingly different from that observed when muon is captured by N atoms in a condensed phase; this difference was interpreted in terms of differing states of ionization during the capture cascade. The (p,t) reaction was used to study states in Pb-203, Ir-189, Ir-191, and Lu-174. Triton energy spectra are shown, along with an energy-level diagram of the states deduced in Lu-174. ERA

N78-25886# Indiana Univ., Bloomington. Dept. of Physics.
NEW DEVELOPMENTS IN HIGH ENERGY PHYSICS
H. A. Neal 1977 32 p Presented at the Sci. Day of Lectures, Morgan State Univ., Baltimore, 28 Apr. 1977
(Contract EY-76-S-02-2009)
(COO-2009-130) Avail: NTIS HC A03/MF A01

Some of the important developments in the field of high energy physics are reviewed. Starting from the status of knowledge of the structure of matter the details of experiments leading to the discovery of charmed particles and psi resonances are emphasized. Also some of the areas of activity of the Indiana University High Energy group are reviewed and related to the principal unsolved problems in the field. ERA

N78-25887# Brookhaven National Lab., Upton, N. Y.
STATUS OF CONSERVED QUANTUM NUMBERS
Maurice Goldhaber 1977 18 p refs Presented at the Conf. on Parity Nonconserv., Weak Neutral Currents and Gauge Theories, Batavia, Ill., 20 Oct. 1977
(Contract EY-76-C-02-0016)
(BNL-23585; Conf-7710107-2) Avail: NTIS HC A02/MF A01

The historical development of conserved quantum numbers is discussed along with the kinds of conservation laws, empirical tests, and particle decays. ERA

N78-25888# Brookhaven National Lab., Upton, N. Y.
REFERENCE NUCLEAR DATA FOR SPACE TECHNOLOGY
T. W. Burrows and N. E. Holden 1977 11 p refs Presented at the Am. Nucl. Soc. 1977 Winter Meeting, San Francisco, 27 Nov. - 2 Dec. 1977
(Contract EY-76-C-02-0016)
(BNL-NCS-23556; Conf-771109-89) Avail: NTIS HC A02/MF A01

Specialized bibliographic searches, data compilations, and data evaluations help the basic and applied research scientist in his work. The National Nuclear Data Center (NNDC) collates and analyzes nuclear physics information, and is concerned with the timely production and revision of reference nuclear data. A frequently revised reference data base in computerized form has the advantage of large quantities of data available without publication delays. The information normally handled by coordinated efforts of NNDC consists of neutron, charged-particle, nuclear structure, radioactive decay, and photonuclear data. ERA

N78-25889# McGill Univ., Montreal (Quebec).
STUDY OF K PION SCATTERING USING THE REACTIONS K(+)-p YIELDS K(+)-PION(+)-n AT 13 GeV
P. Estabrooks, R. K. Carnegie, A. D. Martin, W. M. Dunwoodie, T. A. Lasinski, and D. W. G. S. Leith Feb. 1977 24 p refs Presented at the 18th Intern. Conf. on High Energy Physics, Tbilisi, USSR, 15-21 Jul. 1976 Prepared in cooperation with Stanford Linear Accelerator Center, Calif., Carleton Univ., Ottawa, and Durham Univ., England
(Contract EY-76-S-03-0376)
(SLAC-PUB-1886; Conf-760719-40) Avail: NTIS HC A02/MF A01

High statistics data for the reactions K(+ -)p yields K (+ -) pi(+)n at 13 GeV were obtained in a spectrometer experiment. A t-dependent parametrization of the production amplitudes provides information on both the K pi mass dependence of the productions mechanisms and on K pi scattering. Knowledge of the t-dependence allows a calculation of the K pi partial wave amplitudes for K pi masses from 0.7 to 1.9 GeV. There is evidence in two of the four possible partial wave solutions for a broad P-wave resonant-like structure in the region of 1700 MeV. The K(+)pi(+) reaction is dominated by S-wave scattering with a total cross section of 5.2 mb. The 1 = 1/2 S-wave magnitude rises slowly and smoothly to a maximum near 1400 MeV, but then decreases rapidly between 1400 and 1600 MeV. Both the 1 = 1/2 S-wave below 1400 MeV and the 1 = 3/2 S-wave are well described by an effective range parametrization. ERA

N78-25890# Princeton Univ., N. J. Elementary Particles Lab.
MEASUREMENT OF INCLUSIVE MUON PAIR PRODUCTION BY 225-GeV/c PI(+), PI(-), AND PROTON BEAMS WITH A LARGE ACCEPTANCE SPECTROMETERS Ph.D. Thesis
James G. Branson May 1977 84 p refs
(Contract EY-76-C-02-3072)
(COO-3072-81) Avail: NTIS HC A05/MF A01

Inclusive muon pair production by 225 GeV/c pi(+), pi(-) and proton beams incident upon carbon and tin targets was

measured over a large range of kinematic variables. The value of the invariant cross section is presented as a function of these variables. The vector mesons rho, omega, phi, J and psi (prime) appear in the data along with apparently nonresonant muon pairs. By looking for additional muons accompanying J yields muon (+) muon (-) events, a 1.0% upper limit on production of pairs of charged particles in association with the J is obtained. Aspects of the continuum muon pair data are compared to Drell-Yan model calculations. The ratio of muon-pairs produced by pi(+) beam particles supports electromagnetic production a high mass. ERA

N78-25891# California Univ., Livermore. Lawrence Livermore Lab.
OPERATIONS MANUAL FOR THE MEGACHANNEL GAMMA-RAY COINCIDENCE SYSTEM
W. Ruhter 30 Oct. 1977 36 p refs
(Contract W-7405-eng-48)
(UCID-17603) Avail: NTIS HC A03/MF A01

To aid in the study of nuclear structures, a megachannel pulse-height coincidence analysis system on a PDP-8 computer was constructed. The system digitizes the energies of coincident gamma-rays and stores the resultant information on a moving-head disk. The system uses a minicomputer to sort and store gamma-gamma coincident information on line. The megachannel system and how to use it are described. ERA

74 OPTICS

Includes light phenomena.

N78-25892*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
OPTICAL AND INFRARED TRANSFER FUNCTION OF THE LAGEOS RETROREFLECTOR ARRAY
David A. Arnold May 1978 193 p refs
(Grant NGR-09-015-002)
(NASA-CR-157182) Avail: NTIS HC A09/MF A01 CSCL 20F

The transfer function of the retroreflector array carried by the LAGEOS satellite (1976 39A) was computed at three wavelengths: 5230, 6943, and 106000 A. The range correction is given for extrapolating laser range measurements to the center of gravity of the satellite. The reflectivity of the array was calculated for estimating laser-echo signal strengths. Author

N78-25893*# Union Coll., Schenectady, N.Y. Dept. of Electrical Engineering and Computer Science.
ANALYSIS AND DESIGN OF OPTICALLY PUMPED FAR INFRARED OSCILLATORS AND AMPLIFIERS Final Report, 15 Apr. 1974 - 15 Apr. 1978
T. A. Galantowicz 15 Apr. 1978 46 p refs
(Grant NGR-33-032-004)
(NASA-CR-157213) Avail: NTIS HC A03/MF A01 CSCL 20F

A waveguide laser oscillator was designed and experimental measurements made of relationships among output power, pressure, pump power, pump frequency, cavity tuning, output beam pattern, and cavity mirror properties for various active gases. A waveguide regenerative amplifier was designed and gain measurements were made for various active gases. An external Fabry-Perot interferometer was fabricated and used for accurate wavelength determination and for measurements of the refractive indices of solids transparent in the far infrared. An electronic system was designed and constructed to provide an appropriate error signal for use in feedback control of pump frequency. Pump feedback from the FIR laser was decoupled using a vibrating mirror to phase modulate the pump signal. Author

N78-25894# Stanford Univ., Calif. Electronics Labs.
[IMAGE FORMATION OPTICAL INFORMATION PROCESSING, AND HOLOGRAPHY] Final Report
Joseph W. Goodman 31 Oct. 1977 25 p refs
(Contract N00014-76-C-0514)
(AD-A052691) Avail: NTIS HC A02/MF A01 CSCL 20/6

The research performed under the contracts has spanned the fields of image formation, optical information processing, and holography. In this final report the research accomplishments of the past contract year is summarized. Attention is then turned to an overview of the accomplishments of the entire ten years of support. Major emphasis during the past year has been on the development of new methods for extremely fast, fully parallel, incoherent optical data processing systems. While most coherent optical data processors require information to be input onto a real-time (electronic or electrooptic) transparency in a serial or time-sequential fashion, incoherent processors offer the possibility of fully parallel data input at enormous speeds. The particular approach to incoherent optical processing formulated and partially demonstrated during the past year is summarized in the Appendix, which is a pre-print of an article to appear in Optics Letters in January 1978. GRA

N78-25895# Avco-Everett Research Lab., Everett, Mass.
TURBULENCE ENVIRONMENT CHARACTERIZATION Interim Report, 15 Sep. 1976 - 15 Mar. 1977
M. G. Miller, P. L. Zieske, A. J. Sofia, and R. J. Pepe Jul. 1977 68 p refs
(Contract F30602-76-C-0054; AF Proj. 2646; ARPA Order 2646)
(AD-A052994; RADC-TR-77-232) Avail: NTIS HC A04/MF A01 CSCL 20/6

This report contains discussions of a variety of activities and results relative to the characterization of atmospheric turbulence and its effects on optical propagation at the DARPA AMOS Observatory on Maui, Hawaii. Work carried out during this reporting period has included: (1) deployment and testing of new and/or modified instrumentation; (2) routine data collection; (3) special experiments for instrument characterization and calibration, and, (4) theoretical and statistical analysis of the resulting data. GRA

N78-25896# Northrop Nortronics, Palos Verdes Peninsula, Calif.
OPTICAL COATINGS 2-6 MICRONS Final Technical Report, Jun. 1976 - Dec. 1977
P. Kraatz 7 Apr. 1978 195 p refs
(Contract N00123-76-C-1321)
(AD-A053170; NRTC-78-13R) Avail: NTIS HC A09/MF A01 CSCL 20/6

This report presents and discusses results of an investigation of optical coating materials for the mid infrared with emphasis on the 3.8 micrometers (DF) and 5.3 micrometers (CO) wavelength regions. A data base of experimental information generated under the contract, comprising crystal structure and preferred orientation, deposition parameters, relative growth rates, refractive indices, and absorption coefficients of ten candidate optical thin film materials is presented. This listing of properties is utilized to identify five coating materials, ThF4, PbF2, SiO, ZnSe, and ZnS for intensive study and application in fabricating laser optics. Intensive studies include optimization of deposition conditions, absorptance and film thickness, effects of polycrystalline substrates upon coating structure and absorptance, and determination of survivability in an HF environment. Results of these investigations and of measurement of absorptance, structure, and preferred orientation in multilayer coatings employing these materials are presented and discussed. In addition, the relative merits of CaF2 and SrF2 substrates, critical chemical characteristics of substrate surfaces and cleaning procedures, and effects of substrate crystallographic orientation upon single layer film properties are discussed in detail. Author (GRA)

N78-25897# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MULTICHANNEL INFRARED RECEIVER PERFORMANCE M.S. Thesis
Stephen J. Dunning Dec. 1977 110 p refs
(AD-A052937; AFIT/GE/EE/77-15) Avail: NTIS HC A06/MF A01 CSCL 17/5

The use of passive electro-optical sensors in military systems has received increased emphasis in recent years. In particular, passive infrared sensors could be used in an infrared airborne threat warning receiver. The performance of an optical receiver designed to detect a threat by taking advantage of the spectral signature of the threat is presented. The receiver is based upon

a statistical model which represents the infrared field as a Gaussian random process whose moments depend upon the threat and background characteristics. The optimal Bayes/Neyman-Pearson receiver structure for an M spectral channel, N sequential look scanning receiver is presented and two practical suboptimal receiver structures are developed and compared with two ad hoc linear processor structures. The results indicate that the approximate suboptimal receiver structures and the two ad hoc linear receiver structures have identical performance. The results also show that receiver performance depends upon the difference between the square roots of the hypothesis dependent mean to variance ratios and the ratio of variances, and that receiver performance improves as the number of receiver channels and/or the number of looks increase. Author (GRA)

N78-25898# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Electrical Engineering.

THIN-FILM ACOUSTOOPTIC DEVICES WITH APPLICATIONS TO INTEGRATED/FIBER OPTIC SIGNAL PROCESSING AND COMMUNICATIONS

Chen S. Tsai Feb. 1978 12 p refs
(Grant AF-AFOSR-3187-77)
(AD-A052949; AFOSR-78-0626TR; IR-1) Avail: NTIS HC A02/MF A01 CSCL 20/6

Research emphasis for the first program year was placed on the utilization of the wideband guided-wave (thin-film) acoustooptic deflector for spectrum analysis and very high scanning-rate light beam deflection/switching using analog mode of operation. For this purpose a very wideband deflector in a Y-cut LiNbO3 Ti-diffused waveguide was designed and fabricated. This deflector employs a three-element tilted-array transducer with the center frequencies of 275, 432 and 648 MHz, and has a measured deflector bandwidth of 500 MHz. This bandwidth represents the largest that has been achieved thus far. A frequency resolution of 1.0 MHz was measured in a spectrum analysis experiment using a He-Ne (6328 A) laser light beam of 4 mm aperture. In the light beam scanning experiment, a scanning rate of 125 x 10 to the 6th power spots/sec for 50 spots has been achieved. This scanning rate is 170 times larger than that obtainable in the digital mode of operation. Some preliminary experimental study on optimized anisotropic Bragg diffraction involving optical modes of orthogonal polarizations was also carried out. A measured bandwidth of 222 MHz which represents a seven-fold increase over that based on isotropic Bragg diffraction has been demonstrated. Finally, some improvement in the facility for surface acoustic wave transducer fabrication was also made. Author (GRA)

N78-25899# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A SPECKLE NOISE MODEL FOR OPTICAL HETERODYNE LINE-SCAN IMAGERY M.S. Thesis

Barry W. Lyons Dec. 1977 74 p refs
(AD-A053350; AFIT/GEO/EE/77-4) Avail: NTIS HC A04/MF A01 CSCL 17/8

An imaging system that consists of a laser scanning a surface and a heterodyne receiver that measures the backscattered field is considered. When the scanned surface is rough compared to the wavelength of the incident laser beam the coherent properties of the laser beam are destroyed in the backscattered field. The result is a noise in the image that is referred to as speckle. The rough surface is modeled by multiplying the incident scalar field by a reflectance term and a random phase term. The random phase is modeled as a random process whose mean, variance, and correlation distance are functions of the rough surface. The statistics of the amplitude and amplitude squared of the current from the optical detector are developed in a manner similar to the well known narrowband noise model. Second moment models for detection of the amplitude or amplitude squared are presented. The mean and covariance functions of each model are related to the field correlation function, the reflectance of the surface, and the system parameters. The noise models describe both the average speckle cell size in the image and the contrast in the image caused by the speckle noise. Author (GRA)

N78-25900# Addis Translations International, Portola Valley, Calif.

MATHEMATICAL METHODS FOR PROCESSING IMAGES OBTAINED IN ULTRAHIGH-SPEED ELECTRON-OPTICAL RECORDING

V. N. Platonov, A. M. Prokhorov, Yu. P. Pytev, A. G. Sveshnikov, and M. Ya. Shchelev Aug. 1977 6 p Transl. into ENGLISH of Preprint No. 45 (partial translation) Moscow, Lebedev Phys. Inst., USSR Acad. of Sci., 1977 6 p Sponsored by DOE Prepared for Calif. Univ., Livermore. Lawrence Livermore Lab. (UCRL-Trans-11273) Avail: NTIS HC A02/MF A01

Problems of digital processing of images obtained with ultrahigh-speed electron-optical cameras operating in the linear scanning mode are discussed. The general aspects of digital processing of images such as coding, filtering, and reconstruction are analyzed. A mathematical approach to the estimation of the instrument function of an image converter is proposed. The reconstruction of images distorted by the action of the instrument function of the image converter reduces mathematically to the solution of an integral equation describing the recording system of the image converter. The regularization procedure used in solving such an integral equation is described. Some examples of elimination of geometric distortions in images obtained with the aid of image converters are cited. ERA

N78-25901# Iowa State Univ. of Science and Technology, Ames.

OPTICAL PROPERTIES OF RARE EARTH METALS

D. W. Lynch 1977 13 p refs Presented at 13th Rare Earth Res. Conf., Olgebay Park, West Va., 16 Oct. 1977
(Contract W-7405-eng-82)
(IS-M-122; Conf-771039-8) Avail: NTIS HC A02/MF A01

The optical properties of rare earth metals are reviewed, especially the heavier rare earths. An introduction to optical properties and measurement methods is followed by a discussion of some errors which can arise because of sample properties, errors which may account for the widely disparate results of different investigators. A survey of optical data is presented, including data from electron energy loss measurements, magneto-optic effects, and modulation spectroscopy. The optical properties of rare earths are basically those of transition metals, the 4f electrons and magnetic ordering playing minor, but observable, roles. ERA

N78-25902# California Univ., Livermore. Lawrence Livermore Lab.

EFFICIENT LENSING ELEMENT FOR X-RAYS

N. M. Ceglio and Henry I. Smith (Lincoln Lab., MIT, Lexington, Mass.) 12 Aug. 1977 16 p refs Presented at the 8th Intern. Conf. on X-ray Optics and Microanalysis, Boston, 18-24 Aug. 1977
(Contract W-7405-eng-48)
(UCRL-79966; Conf-770821-4) Avail: NTIS HC A02/MF A01

An efficient X-ray lens with an effective speed of order less than approximately f/50 for lambda greater than approximately 10 A X-rays is described. Fabrication of this lensing element appears feasible using existing microfabrication technology. Diffraction and refraction are coupled in a single element to achieve efficient X-ray concentration into a single order focal spot. Diffraction is used to produce efficient ray bending (without absorption) while refraction is used only to provide appropriate phase adjustment among the various diffraction orders to insure what is essentially a single order output. The mechanism for ray bending (diffraction) is decoupled from the absorption mechanism. Refraction is used only to achieve small shifts in phase so that the associated attenuation need not be prohibitive. The X-ray lens might be described as a Blazed Fresnel Phase Plate (BFPP) with a spatially distributed phase shift within each Fresnel zone. The spatial distribution of the phase shifts is chosen to concentrate essentially all of the unabsorbed energy into a single focal spot. ERA

N78-25903# California Univ., Berkeley. Lawrence Berkeley Lab.

THIN WINDOW Si(Li) DETECTORS FOR THE ISEE-C TELESCOPE

J. T. Walton, H. A. Sonner, D. E. Greiner, and F. S. Bieser Oct. 1977 5 p refs Presented at Nucl. Sci. Symp., San Francisco, 19 Oct. 1977
(Contract W-7405-eng-48)

(LBL-6434 Conf-771023-31) Avail: NTIS HC A02/MF A01

Special detectors were developed for the NASA ISSEE-C Cosmic Ray Telescope. These are Li-drifted silicon detectors 5 mm thick and 1500 sq mm area with the criteria that thickness variations on the whole area be less than + or - 10 microns and that the Li-diffused contact dead-layer not exceed 15 microns. Techniques used to fabricate and test these detectors are presented. ERA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N78-25904# Oak Ridge National Lab., Tenn.

PROGRAM PLAN FOR ELECTRON CYCLOTRON HEATING EXPERIMENTS ON THE ISX TOKAMAK

A. C. England, C. M. Loring, O. C. Eldridge, W. Namkung, H. C. Howe, G. L. Campen, H. L. Mitchell, and D. B. Batchelor Oct. 1977 49 p refs

(Contract W-7405-eng-26)

(ORNL-TM-6011) Avail: NTIS HC A03/MF A01

Electron cyclotron heating (ECH) experiments on the Oak Ridge Tokamak, ISX-B, will attempt bulk heating, preionization, and current profile control. The ECH principle will first be tested using a single 200 kW, 28 GHz gyrotron. A second tube will then be added for high beta studies, and assuming successful heating experiments, an additional eight tubes will be used for a flux conserving Tokamak emperiment. A design description of the proposed experiments is presented along with results of some theoretical analyses to predict performance. Estimates of costs and schedules are included. ERA

N78-25905# Addis Translations International, Portola Valley, Calif.

ENERGY PRINCIPLE IN A STRONG MAGNETIC FIELD AND THE HELICAL INSTABILITY OF A TOROIDAL PLASMA PINCH

O. P. Pogutse and E. I. Yurchenko 1977 21 p Transl. into ENGLISH from Russian Report (USSR) p 21

(UCRL-Trans-11283) Avail: NTIS HC A02/MF A01

An expression in which the kinetic and potential energy are a functional of only one function was derived for the energy principle by expanding an exact expression in reciprocal powers of a strong toroidal magnetic field. This simplified energy principle is valid up to terms quadratic in curvature and is applied to a study of the helical instability of a toroidal plasma pinch. The toroidal curvature is shown to cause splitting of the branches and the appearance of forbidden bands in the spectrum of unstable Alfven oscillations. The appearance of these bands clearly shows how the instability of the plasma declines with increasing plasma pressure. This effect is proportional to the curvature and pressure of the plasma and can apparently account for the pressure constraint observed in recent numerical calculations of the stability of a Tokamak with a large beta. ERA

N78-25906# Argonne National Lab., Ill.

RESISTIVE REQUIREMENTS FOR THE VACUUM WALL OF A TOKAMAK FUSION REACTOR

J. N. Brooks, D. Ehst, S. D. Harkness, J. Norem, H. Stevens, and L. Turner 1977 7 p refs Presented at the 7th Symp. on Eng. Probl. of Fusion Res., Knoxville, Tenn., 25-28 Oct. 1977

(Contract W-31-109-eng-38)

(CONF-771029-182) Avail: NTIS HC A02/MF A01

The effect of having a conducting vacuum wall, instead of one with a flux breaker, has been analyzed from a multi-disciplinary standpoint. There is a good indication that a conducting wall will be tolerable. The most serious problems seem to be in designing an acceptable initiation-trimming coil system and in designing a vacuum wall that can withstand the pressure and heat loads following a plasma dump. There appear to be several promising design approaches for the vacuum wall that can achieve a fairly high resistance and may satisfy the latter constraints. ERA

N78-25907# Oak Ridge National Lab., Tenn.

EVALUATION OF THE FATIGUE RESISTANCE OF CDA 182 COPPER FOR USE IN THE IMPURITY STUDY EXPERIMENT FUSION RESEARCH TOKAMAK (ISX)

W. R. Corwin, R. O. Hussing, D. C. Lousteau, and M. W. Poore Jan. 1978 35 p refs

(Contract W-7405-eng-26)

(ORNL-5302) Avail: NTIS HC A03/MF A01

The fatigue behavior of heat-treated, work-hardened CDA 182, a Cu-1 percent Cr alloy, was evaluated under load-controlled cycling in fully reversed and zero-to-maximum-tension uniaxial fatigue tests at room temperature. Cyclic softening and tensile rachetting both occurred during fully reversed cycling, but neither occurred in the zero-to-maximum-tension tests. Varying degrees of nonisotropic deformation were observed under both conditions of loading. Increasing the testing temperature to 66 C (150 F) slightly reduced fatigue strength but did not affect the cyclic strain response. In addition to uniaxial tests, prototype specimens of the weakest link in the ISX design for CDA 182, an interlocking finger joint, were tested under load control. These tests assessed the degrading effect of stress concentrations in the joint on the fatigue resistance of the material. The prototypic tests simulated both normal and above-normal loading conditions. ERA

N78-25908# Oak Ridge National Lab., Tenn.

ELEMENTARY ELECTRON-MOLECULE INTERACTIONS AND NEGATIVE ION RESONANCES AT SUBEXCITATION ENERGIES AND THEIR SIGNIFICANCE IN GASEOUS DIELECTRICS

Loucas G. Christophorou 1977 22 p refs Presented at the 13th Intern. Conf. on Phenomena in Ionized Gases, Berlin, Sep. 1977

(Contract W-7405-eng-26)

(CONF-770930-1) Avail: NTIS HC A02/MF A01

Recent knowledge on low-energy (mostly approximately less than 10 eV) electron-molecule interaction processes in dilute and in dense gases is synthesized, discussed, and related to the breakdown strength of gaseous dielectrics. Optimal design of multicomponent gaseous insulators can be made on the basis of such knowledge. ERA

N78-25909# McDonnell-Douglas Corp., St. Louis, Mo.

DEVELOPING MAINTAINABILITY FOR TOKAMAK FUSION POWER SYSTEMS, PHASE 1 REPORT. VOLUME 1: STUDY RESULTS

H. S. Zahn et al Oct. 1977 200 p refs 2 Vol.

(Contract EG-77-C-02-4184)

(COO-4184-4-Vol-1) Avail: NTIS HC A09/MF A01

Design features of Tokamak fusion power reactors are defined which contribute to the achievement of high levels of maintainability. The principal emphasis is on scheduled maintenance whose frequency is determined by the life of the reactor first wall/blanket. Remote operations are baselined. Five conceptual reactor designs have been analyzed. Each concept is characterized by the size of the replaceable first wall/blanket module-large, intermediate, small-and whether access to the module was from the outside of the reactor, the inside of the reactor or a combination of both. The study results are expressed in terms of availability, the costs of maintenance and the precent effect of maintenance on the cost of electricity. ERA

N78-25910# McDonnell-Douglas Corp., St. Louis, Mo.

DEVELOPING MAINTAINABILITY FOR TOKAMAK FUSION POWER SYSTEMS, PHASE 1 REPORT. VOLUME 2: APPENDICES

H. S. Zahn et al Oct. 1977 555 p refs 2 Vol.

(Contract EG-77-C-02-4184)

(COO-4184-4-Vol-2) Avail: NTIS HC A24/MF A01

The following appendices are reported: (1) baseline large module time estimates; (2) baseline intermediate module time estimates; (3) baseline small module time estimates; (4) alternate concept estimates; (5) maintenance equipment concepts; (6) additional reactor design definition; and (7) TOCOMO supplements. ERA

N78-25911# Oak Ridge National Lab., Tenn.

ORNL-TNS/PEPR OVERALL HEATING REQUIREMENTS

Y-K. M. Peng and J. A. Rome 1977 35 p refs Presented at the Plasma Heating Develop. Requirements Workshop, Gaithersburg, Md., 5 Dec. 1977
(Contract W-7405-eng-26)
(CONF-771213-3) Avail: NTIS HC A03/MF A01

Plasma heating requirements needed to demonstrate the fusion reactor core in the mid-to-late 1980's and to extrapolate to an economic Tokamak power reactor were investigated. Topics discussed include: neutral beams as the primary heating method, the electron-cyclotron resonance heating at a lower power level for profile control, and the upper hybrid resonance initiation and preheating of currentless plasmas to reduce current start-up loop voltage (V/sub I/) requirements. ERA

N78-25912# Stevens Inst. of Tech., Hoboken, N. J. Dept. of Physics and Engineering Physics.
INVESTIGATIONS IN PLASMA DYNAMICS Annual Progress Report, 15 Sep. 1976 - 15 Sep. 1977
George Schmidt Sep. 1977 7 p refs
(Contract EY-76-S-02-3004)
(COO-3004-23) Avail: NTIS HC A02/MF A01

The effect of lower hybrid heating on drift modes was studied, and it was found that lower hybrid heating can modify the drift wave spectrum. The coupling of unstable drift waves by a process akin to nonlinear Landau damping was investigated and it was found that the drift wave spectrum tends toward isotropy in the plane perpendicular to the magnetic field, in agreement with experiments. Finally, it was shown that the purely growing drift mode is stabilized by magnetic shear in Tokamak devices. ERA

N78-25913# California Univ., Livermore. Lawrence Livermore Lab.
HIGH RESOLUTION X-RAY CRYSTAL SPECTROGRAPHS
L. N. Koppel and J. D. Eckels Oct. 1977 19 p refs Presented at the APS Plasma Phys. Meeting of the Am. Phys. Soc., Atlanta, 5-11 Nov. 1977
(Contract W-7405-eng-48)
(UCRL-79781; Conf-771136-17) Avail: NTIS HC A02/MF A01

Observation of X-ray line emissions are valuable for determining the thermodynamic state of the emitting plasma. For laser produced plasmas, diffraction crystals can be used to isolate X-ray monochromes to obtain high resolution spectral measurements. A versatile multi-crystal high resolution spectrograph used for photon energies from 0.5 to 6 keV is described. A calculational package that tunes the response and sensitivity of the instrument and estimates the effect of source extent on spectral resolution is discussed as well as a scheme using fine slits to obtain spatial resolution with the basic instrument. The design rationale for the crystal stage of an instrument combining a streak camera and a diffraction crystal for Shiva diagnostics is examined. ERA

N78-25914# Los Alamos Scientific Lab., N. Mex.
AUTOMATED COMPUTER ANALYSIS OF PLASMA-STREAK TRACES FROM SCYLLAC
R. L. Whitman, F. C. Jahoda, and R. P. Kruger 1977 22 p refs Presented at the Digital Signal Process Symp., Albuquerque, N. Mex., 6-7 Dec. 1977
(Contract W-7405-eng-36)
(LA-UR-77-2582; Conf-771206-11) Avail: NTIS HC A02/MF A01

An automated computer analysis technique that locates and references the approximate centroid of single- or dual-streak traces is described. The technique also determines the plasma-trace width over a limited self-adjusting region. The plasma traces are recorded with streak cameras on Polaroid film, then scanned and digitized for processing. The analysis technique uses scene segmentation to separate the plasma trace from a reference fiducial trace. The technique employs two methods of peak detection; one for the plasma trace and one for the fiducial trace. The width is obtained using an edge-detection, or slope, method. Timing data are derived from the intensity modulation of the fiducial trace. To smooth (despike) the output graphs showing the plasma-trace centroid and width, a technique of twicing was employed. In addition an interactive sorting algorithm allows retrieval of the centroid, width, and fiducial data from any test shot plasma for post analysis. ERA

N78-25915# Department of Energy, Washington, D. C. Div. of Magnetic Fusion Energy.
SUPERCONDUCTING MAGNET DEVELOPMENT FOR TOKAMAKS AND MIRRORS: A TECHNICAL ASSESSMENT
C. Laverick, R. B. Jacobs, R. W. Boom, and C. D. Henning Nov. 1977 29 p
(DOE/ET-0016) Avail: NTIS HC A03/MF A01

The role of superconducting magnets in Magnetic Fusion Energy Research and Development is assessed from a consideration of program plans and schedules, the present status of the programs and the research and development suggestions arising from recent studies and workshops. A principal conclusion is that the large superconducting magnet systems needed for commercial magnetic fusion reactors can be constructed. However, such magnets working under severe conditions with increasingly stringent reliability, safety and cost restrictions can never be built unless experience is first gained in a number of important installations designed to prove physics and technology steps on the way to commercial power demonstration. The immediate problem is to design a technology program in the absence of definite device needs and specifications, giving a priority weighting to the multiplicity of good, high quality development program suggestions when all proposals cannot be supported. ERA

N78-25916# Oak Ridge National Lab., Tenn.
EQUILIBRIUM FIELD COILS AND FREE-BOUNDARY EQUILIBRIUM CONSIDERATIONS FOR TNS
Y. K. M. Peng and D. J. Strickler 1977 8 p refs Presented at the ANS Winter Meeting, San Francisco, 27 Nov. 1977
(Contract W-7405-eng-26)
(CONF-771109-59) Avail: NTIS HC A02/MF A01

Following a procedure similar to the method of virtual casing, external coil arrangements were produced that reproduce the ideal vaccum vertical field B/sub/z// sup ID/for a D-shaped plasma to within a few percent root-mean squared deviation. A typical coil system and a free-boundary equilibrium are shown. It is seen that D-shaped equilibria can be with the external coils. Again, three sets of coils are sufficient for centering and shaping the plasma for the range of anti Beta values of interest. It is concluded that placing the equilibrium field coils external to the toroidal field coils has the potential of substantially reducing the cost and complexity of the D-shaped the next step device. ERA

N78-25917# Argonne National Lab., Ill.
EQUILIBRIUM FIELD COIL SYSTEM FOR THE ARGONNE EPR DESIGN
J. N. Brooks, K. Evans, Jr., H. Stevens, and L. Turner 1977 7 p refs Presented at 7th Symp. on Fusion Res. Proj., Knoxville, Tenn., 25 Oct. 1977
(Contract W-31-109-eng-38)
(CONF-771029-181) Avail: NTIS HC A02/MF A01

The equilibrium field (EF) coil system for the Argonne Experimental Power Reactor and the methods by which it was designed are described. The number of coils, their placement, and the currents in them are fixed by considerations of the trade off between the stored energy in the coils and the closeness with which the required magnetohydrodynamic equilibrium can be matched. The bulk of the equilibrium field is produced by superconducting coils outside the toroidal field coils. These coils are decoupled from the ohmic heating system. Normal conducting coils just outside the vacuum chamber are also provided for fine control. The amount of D-shapedness of the plasma cross section is found to be limited. The reference design EF coil system configuration is described, and the internal configuration of the conductor and implications of the EF coil system on the reactor burn cycle and on the driving system costs are discussed. ERA

N78-25918# Princeton Univ., N. J.
TFTR COIL CASE DESIGN
J. Pusateri (Grumman Aerospace Corp., Bethpage, N. Y.), G. Barnes (Grumman Aerospace Corp., Bethpage, N. Y.), and J. Citrolo 1977 5 p refs Presented at 7th Symp. on Fusion Res. Proj., Knoxville, Tenn., 25 Oct. 1977
(Contract EY-76-C-02-3073)

(CONF-771029-139) Avail: NTIS HC A02/MF A01

The Tokamak fusion test reactor toroidal field coil cases are highly loaded structures designed within severe constraints. Foremost among these are basic machine geometry, material characteristics of both the case and the copper/epoxy matrix it supports, and overall cost. Scoping and parametric studies were performed continuously since conceptual design. The progression of design decisions including coil shape, support locations and their stiffnesses, material selection, and element sizing are described. The significant variables are identified for each of the studies. The current coil case design is presented along with aspects of the design still under consideration. Questions that remain involve the effects of limitations placed upon the coil materials (copper, epoxy) themselves. Resolution of these questions is to be accomplished by development tests of coil elements similar to those in the current design. ERA

N78-25919# Oak Ridge National Lab., Tenn.
SENSITIVITY OF THE FIRST-WALL RADIATION DAMAGE TO FUSION REACTOR BLANKET COMPOSITION
J. M. Barnes, R. T. Santoro, and T. A. Gabriel Dec. 1977 13 p refs
(Contract W-7405-eng-26)
(ORNL-TM-6105) Avail: NTIS HC A02/MF A01

The atomic displacement and hydrogen and helium gas production rates in a 1 cm thick type-316 stainless steel first wall were calculated as a function of blanket composition in a typical one dimensional fusion reactor model. For a 50 cm thick blanket, variations in the rates of atomic displacement and hydrogen and helium gas production of factors of 2.7, 1.3, and 1.2, respectively, were obtained. The dependence of the radiation damage responses on the thickness of the first wall and blanket are also given. ERA

N78-25920# Department of Energy, Washington, D. C. Div. of Magnetic Fusion Energy.
TOKAMAK IMPURITY REPORT
Dec. 1977 136 p refs
(DOE/ET-0001) Avail: NTIS HC A07/MF A01

In May 1976, a meeting of Tokamak physicists was held in order to discuss what is known about impurities in Tokamaks, what one should be able to learn from planned experiments, and what issues remain unaddressed by present or future programs. Background and perspective for discussion as well as detailed information on impurities in Tokamaks is given. Attention was focused on impurities, the effects of neutral beam heating on impurity generation and the effects of impurities on neutral beam penetration and heating are presented. ERA

N78-25921# California Univ., Livermore. Lawrence Livermore Lab.
EFFI: A CODE FOR CALCULATING THE ELECTROMAGNETIC FIELD, FORCE, AND INDUCTANCE IN COIL SYSTEMS OF ARBITRARY GEOMETRY; USER'S MANUAL
S. J. Sackett 5 May 1977 48 p refs
(Contract W-7405-eng-48)
(UCID-17621) Avail: NTIS HC A03/MF A01

The preparation of input to the code and the output options available are described. Several examples, including the magnet design for MFTF and a divertor design for a Tokamak are used for illustration. All input to EFFI is format free, and is checked for validity before any calculations are done. To aid the user in correcting mistakes, each error detected produces a diagnostic giving the objection to the data and the number of the offending data card. If no errors are detected, the program automatically expands memory to the size required for the problem. Each page of output is labeled with the problem title; the time, machine, and data of the run; and the version number and compile data for EFFI. In addition, each column of numbers on each page is appropriately labeled. Plots of field contours, field profiles, flux lines, field magnitude along a flux line, and forces can all be obtained at the option of the user. On field contour and flux line plots, lines of intersection between the coils and the plotting plane are also shown. ERA

N78-25922# Princeton Univ., N. J.
TFTR MOTOR GENERATOR
J. G. Murray, G. Bronner, and M. Horton (GE Co., Schenectady, N. Y.) 1977 6 p refs Presented at 7th Symp. on Fusion Res. Project, Knoxville, Tenn., 25 Oct. 1977
(Contract EY-76-C-02-3073)
(CONF-771029-151) Avail: NTIS HC A02/MF A01

A general description is given of 475 MVA pulsed motor generators for TFTR at Princeton Plasma Physics Laboratory. Two identical generators operating in parallel are capable of supplying 950 MVA for an equivalent square pulse of 6.77 seconds and 4,500 MJ at 0.7 power factor to provide the energy for the pulsed electrical coils and heating system for TFTR. The description includes the operational features of the 15,000 HP wound rotor motors driving each generator with its starting equipment and cycloconverter for controlling speed, power factor, and regulating line voltage during load pulsing shere the generator speed changes from 87.5 to 60 Hz frequently variation to provide the 4,500 MJ or energy. The special design characteristics such as fatigue stress calculations for 1,000,000 cycles of operation, forcing factor on exciter to provide regulation, and low generator impedance are reviewed. ERA

N78-25923# Argonne National Lab., Ill.
PLASMA DRIVING SYSTEM REQUIREMENTS FOR COMMERCIAL TOKAMAK FUSION REACTORS
J. N. Brooks 1977 8 p refs Presented at the 7th Symp. on Fusion Res. Proj., Knoxville, Tenn., 25 Oct. 1977
(Contract W-31-109-eng-38)
(CONF-771029-191) Avail: NTIS HC A02/MF A01

Results for a single reactor configuration together with several design concepts for the driving system are summarized. Both the reactor configuration and the driving system concepts are natural extensions from the EPR. Thus, the new results can be compared with the previous EPR results to obtain a consistent picture of how the driving system requirements will evolve--for one particular design configuration. ERA

N78-25924# Oak Ridge National Lab., Tenn.
HYBRID EQUILIBRIUM FIELD COILS FOR THE ORNL TNS
Y. K. M. Peng, D. J. Strickler, and R. A. Dory 1977 7 p refs Presented at the 7th Symp. on Fusion Res. Proj., Knoxville, Tenn., 25 Oct. 1977
(Contract W-7405-eng-26)
(CONF-771029-192) Avail: NTIS HC A02/MF A01

A comparative study of the power supplies required by interior and exterior to the toroidal field (TF) coils eqilibrium field coils that are separately appropriate for high-beta, D-shaped plasmas in TNS is presented. It is shown that the interior coils need power supplies that are an order of magnitude below those required by the exterior coils. A hybrid EF coil concept was proposed that combines the interior and the exterior coils to retain their advantages in avoiding large interior coils while lowering the power supplied to the exterior coils by an order of magnitude. ERA

N78-25925# Los Alamos Scientific Lab., N. Mex.
CURRENT CONTROL BY A HOMOPOLAR MACHINE WITH MOVING BRUSHES
H. Vogel Jan. 1978 10 p
(Contract W-7405-eng-36)
(LA-7090-MS) Avail: NTIS HC A02/MF A01

The equation for TNS Doublet's E-coil circuit with moving brush homopolar machine is integrated in the flux of the homopolar for a monotonically increasing current function extending beyond the current reversal into the burn period. The results show that the moving brush feature is not useful for controlling the burn. ERA

N78-25926# Oak Ridge National Lab., Tenn.
SENSITIVITY OF IGNITION IN TNS TO FUELING PROFILES AND RADIAL TRANSPORT PROCESSES
W. A. Houlberg, A. T. Mense, and S. E. Attenberger 1977 4 p refs Presented at the 7th Symp. on Fusion Res. Proj., Knoxville, Tenn., 25 Oct. 1977
(CONF-771029-87) Avail: NTIS HC A02/MF A01

Studies were undertaken to determine the sensitivity of ignition in The Next Step (TNS) to radial transport models and particle fueling penetration depths. A one dimensional multifluid transport model was used for the ion, electron, and thermal alpha energy balances and the ion and alpha densities. A startup

scenario at full plasma size and constant average density is used with 2 sec of beam heating to determine whether the plasma ignites. The density gradient driven, trapped particle microinstabilities are found to be very sensitive to the particle fueling profile, which may allow optimization of the startup scenario. ERA

N78-25927# California Univ., Berkeley. Lawrence Berkeley Lab.
RECTANGULARLY SHAPED LARGE AREA PLASMA SOURCE
K. W. Ehlers Oct. 1977 5 p refs Presented at the 7th Symp. on Fusion Res. Proj., Knoxville, Tenn., 25 Oct. 1977
(Contract W-7405-eng-48)
(LBL-6373; Conf-771029-198) Avail: NTIS HC A02/MF A01

The next generation of U.S. fusion experiments, which includes the TFTR, MFTF, and Doublet 3, will all utilize the injection of highly energetic neutral beams for plasma heating. Some of the requirements for the plasma sources from which these beams will originate are discussed and the operating characteristics of the plasma source which was developed for the Tokamak Fusion Test Reactor (TFTR) beam lines are described. ERA

N78-25928# California Univ., Berkeley. Lawrence Berkeley Lab.
DESIGN AND FABRICATION OF AN ION ACCELERATOR FOR TFTR-TYPE NEUTRAL BEAM SYSTEMS
J. A. Paterson, T. J. Duffy, J. M. Haughiah, L. A. Biagi, and D. P. Yee Oct. 1977 6 p refs Presented at the 7th Symp. on Eng. Probl. of Fusion Res., Knoxville, Tenn., 25-28 Oct. 1977
(Contract W-7405-eng-48)
(LBL-6374; Conf-771029-179) Avail: NTIS HC A02/MF A01

The design of the prototype 120 keV, 65 A, 0.5 sec ion accelerator for TFTR-type beam systems is described. Details of the manufacture of the constituent parts are given along with descriptions of the major components of the accelerator. The molybdenum grids structures, molybdenum shields, stainless steel hats, and the epoxy insulation are included. Specific manufacturing problems are discussed along with the results of tests to determine the voltage holding capabilities of the assembly. ERA

N78-25929# Argonne National Lab., Ill.
THERMAL STRESS AND CREEP FATIGUE LIMITATIONS IN FIRST WALL DESIGN
S. Majumdar, B. Misra, and S. D. Harkness 1977 20 p refs Presented at the IAEA Conf. and Workshop on Fusion Reactor Design, Madison, Wis., 10-21 Oct. 1977
(Contract W-31-109-eng-38)
(CONF-771056-8) Avail: NTIS HC A02/MF A01

The thermal-hydraulic performance of a lithium cooled cylindrical first wall module was analyzed as a function of the incident neutron wall loading. Three criteria were established for the purpose of defining the maximum wall loading. Three criteria were established for the purpose of defining the maximum wall loading allowable for modules constructed of Type 316 stainless steel and a vanadium alloy. Of the three, the maximum structural temperature criterion of 750 C for vanadium resulted in the limiting wall loading value of 7 MW sq m. The second criterion limited thermal stress levels to the yield strength of the alloy. This led to the lowest wall loading value for the Type 316 stainless steel wall (1.7 MW sq m). The third criterion required that the creep-fatigue characteristics of the module allow a lifetime of 10 MW yr sq m. At wall temperatures of 600 C, this lifetime could be achieved in a stainless steel module for wall loadings less than 3.2 MW sq m, while the same lifetime could be achieved for much higher wall loadings in a vanadium module. ERA

N78-25930# Argonne National Lab., Ill.
THERMAL HYDRAULIC ANALYSES OF TWO FUSION REACTOR FIRST WALL/BLANKET CONCEPTS
B. Misra and V. A. Maroni 1977 8 p refs Presented at the 7th Symp. on Eng. Probl. of Fusion Res., Knoxville, Tenn., 25-28 Oct. 1977
(Contract W-31-109-eng-38)
(CONF-771029-178) Avail: NTIS HC A02/MF A01

Two liquid lithium blanket concepts for Tokamak-type reactors are discussed and compared. In one concept, lithium is circulated through 60 cm deep cylindrical modules oriented so that the module axis is parallel to the reactor minor radius. In the other, helium carrying channels oriented parallel to the first wall are used to cool a 60 cm thick stagnant lithium blanket. Paralleling studies were carried out wherein the thermal and structural properties of the construction materials were based on those projected for either solution-annealed 316 stainless steel or vanadium-base alloys. The effects of limitations on allowable peak structural temperature, material strength, thermal stress, coolant inlet temperature, and pumping power/thermal power ratio were evaluated. Consequences to thermal hydraulic performance resulting from the presence of or absence of a divertor were also investigated. ERA

N78-25931# Grumman Aerospace Corp., Bethpage, N.Y.
THERMOSTRUCTURAL AND MECHANICAL ASPECTS OF THE TFTR PLASMA LIMITER DESIGN
R. Condolff and S. Fixler 1977 9 p refs Presented at the 7th Symp. on Fusion Res. Proj., Knoxville, Tenn., 25 Oct. 1977
(Contract EY-76-C-02-3073)
(CONF-771029-158) Avail: NTIS HC A02/MF A01

The preliminary mechanical and thermostructural aspects of the TOKAMAK fusion test reactor plasma limiter design are discussed. The evolution of the limiter design is traced through the various stages from conceptual design to the present state. Parametric limiter blade study results are presented. Design criteria, requirements, design loads (mechanical and thermal), material considerations, and remote handling problems are described. The design approach used to achieve a satisfactory plasma limiter and blade is examined. ERA

N78-25932# Institute of Gas Technology, Chicago, Ill.
APPROACH TO DECISION MODELING FOR AN IGNITION TEST REACTOR
H. R. Howland Pittsburgh Westinghouse Electric Corp. 30 Sep. 1977 16 p refs Presented at the 7th Symp. on Eng. Probl. of Fusion Research, Knoxville, Tenn., 25-28 Oct. 1977 Prepared for ORNL
(Contracts W-7405-eng-26)
(WFPS-TME-066; Conf-771029-166) Avail: NTIS HC A02/MF A01

A comparison matrix decision model applied to candidates for a D-T ignition Tokamak (TNS), including assessment of semiquantifiable or judgemental factors as well as quantitative ones, indicates that TNS is mission-sensitive with a choice implied between near-term achievability and reactor technology. ERA

N78-25933# California Univ., Livermore. Lawrence Livermore Lab.
FUSION DEVICES
T. K. Fowler Oct. 1977 33 p Presented at the EPRI Executive Seminar on Fusion, San Francisco, 11-13 Oct. 1977
(Contract W-7405-eng-48)
(UCRL-80060; Conf-771071-1) Avail: NTIS HC A03/MF A01

Types of thermonuclear fusion devices currently under development are reviewed for an electric utilities management audience. Overall design features of laser fusion, Tokamak, and magnetic mirror type reactors are described and illustrated. Thrusts and trends in current research on these devices that promise to improve performance are briefly reviewed. Twenty photographs and drawings are included. ERA

N78-25934# Oak Ridge National Lab., Tenn.
DRAFT PROGRAM PLAN FOR TNS, THE NEXT STEP AFTER THE TOKAMAK FUSION TEST REACTOR. PART 2: R AND D NEEDS ASSESSMENT
M. Roberts Dec. 1977 144 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5983-Pt-2) Avail: NTIS HC A07/MF A01

The information represents the brief but intensive efforts to answer the following questions: (1) Is there an adequate basis of R and D support for the TNS program as a central, ambitious goal for the fusion program. (2) What are the principal gaps in the current and projected R and D programs. (3) What must be done to permit operation of TNS in the mid 1980s. The findings of the preliminary study provide these answers to the questions: (1) The physics and technology base does exist from which to start the TNS design as a central fusion program goal. (2) Specific

recommendations are had for new emphasis in certain physics and technology areas to minimize R and D program gaps. (3) TNS conceptual design must be started now, and a close look at organizing the fusion program around a TNS project is an essential need to support operation in the mid 1980s. ERA

N78-25935# Parsons (Ralph M.) Co., Pasadena, Calif.
GAC-ANL TNS SCOPING STUDIES. VOLUME 10: ENGINEERING SUPPORT, FACILITY STUDIES Status Report, 1 Oct. 1976 - 30 Sep. 1977
Oct. 1977 142 p refs
(Contract EY-76-C-03-0167-038)
(GA-A-14614-Vol-10) Avail: NTIS HC A07/MF A01

A supporting facility was arranged around a baseline 3.8 m ignition test reactor (ITR). The constructed costs of the balance-of-plant (BOP) supporting buildings and systems necessary for the ITR operation was conceptually designed and estimated. In addition to facility design and cost estimate, this scoping study also includes the program planning and quality assurance for the TNS program. In terms of BOP functional design assurance, schedule implication, and preliminary cost tradeoff, the potential impacts evolving from developmental changes to the Tokamak parameters and from various ITR upgrade scenarios was examined. Recommendations were made suggesting areas of consideration which may lead to further cost savings in the TNS program. ERA

N78-25936# Department of Energy, Washington, D. C.
SURVEY OF PARTICLE CODES IN THE MAGNETIC FUSION ENERGY PROGRAM
Dec. 1977 65 p refs
(DOE/ET-0003) Avail: NTIS HC A04/MF A01

The Fusion Plasma Theory Branch of the Division of Magnetic Fusion Energy conducted a survey of all the physics computer codes being supported at that time. The purpose of that survey was to allow DMFE to prepare a description of the codes for distribution to the plasma physics community. This document is the first of several planned and covers those types of codes which treat the plasma as a group of particles. ERA

N78-25937# General Atomic Co., San Diego, Calif.
STRUCTURAL DESIGN CONSIDERATIONS FOR A FREE STANDING ITR VACUUM VESSEL
J. A. DAlessandro Sep. 1977 7 p refs Presented at the 7th Symp. on Eng. Probl. of Fusion Res., Knoxville, Tenn., 25-28 Oct. 1977
(Contract EY-76-C-03-0167-038)
(GA-A-14649; Conf-771029-135) Avail: NTIS HC A02/MF A01

The structural considerations used to develop a reference design for the 3.8 m GA/ANL TNS (ITR) vacuum vessel are defined. A description of the design specifications, loading conditions, and the method of structural analysis is included. The primary loading governing the design is that due to a plasma disruption. The electrical resistance in the toroidal direction governs the time duration of this loading and is inversely proportional to the wall thickness, which governs structural strength. For a given material, this leads to a fully stressed design of minimum wall thickness. It is determined that using Inconel 625 results in an acceptable resistance of 0.2 microns thereby eliminating the necessity of using bellows or dielectric breaks. ERA

N78-25938# Illinois Univ., Urbana. Fusion Studies Lab.
EXPLORATORY STUDIES OF HIGH-EFFICIENCY ADVANCE FUEL FUSION REACTORS Annual Report, Feb. 1977
Nov. 1977 175 p refs Prepared in cooperation with BNL and California Univ., Lawrence Livermore Lab.
(EPRI Proj. 645)
(EPRI-ER-581) Avail: NTIS HC A08/MF A01

The potential advantages and feasibility of using deuterium and D-He-3 fusion fuels rather than D-T are examined. The present report describes the first part of the study which was concerned with the use of Tokamak reactors to burn such fuels on the expectation that, due to the emphasis on such systems in the national R and D program, they will form the basis for the first generation of fusion power plants. Parameters are presented for three classes of reactors: D-D plants designed for He-3 generations as well as electrical production; D-He-3 Tokamak that would serve as satellites to the generators by burning He-3 in smaller, relatively clean plants suitable for near-urban siting; and self-contained catalyzed-D Tokamaks that burn T and He-3 from D-D fusion in-situ. The size scaling for these plants is, in descending order, D-D generators, catalyzed-D plants, and D-He-3 satellites. This flexibility in size and fuel allows a wide variation in characteristics that could well be vital to the full utilization of fusion power. ERA

N78-25939# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
ECONOMIC IMPACT OF USING REFRACTORY METALS FOR FUSION REACTORS, PHASE 1
J. W. Davis Oct. 1977 44 p refs
(Contract EG-77-C-02-4247)
(COO-4247-1) Avail: NTIS HC A03/MF A01

The following topics were considered: (1) TOCOMO computer code, (2) selection of a baseline reactor configuration, (3) selection of a power conversion system, (4) selection of refractory metals, (5) use of refractory metals in the first wall and blanket, (6) use of refractory metals in the primary coolant loop, and (7) the economic consequence of using an advanced conversion cycle. ERA

N78-25940# Sandia Labs., Albuquerque, N. Mex.
TOKAMAK FIRST-WALL COATING PROGRAM DEVELOPMENT
Mark J. Davis, Robert A. Langley, and Thomas S. Prevender Aug. 1977 64 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1027) Avail: NTIS HC A04/MF A01

A research program to study coatings for control of impurities originating from the first wall of a Tokamak reactor is discussed. The first wall environment and sputtering, temperature, surface chemical, and bulk radiation damage effects are reviewed. Candidate materials and application techniques are discussed. The philosophy and flow chart of a recommended coating development plan are presented and analyzed. Projected impacts of the proposed plan include benefits to other aspects of confinement experiments. A list of 45 references is appended. ERA

N78-25941# Grumman Aerospace Corp., Bethpage, N.Y.
CRYOGENIC SUPPLIES FOR THE TFTR NEUTRAL BEAM LINE CRYOPANELS
G. Pinter 1977 5 p Presented at the 7th Symp. on Fusion Res. Proj., Knoxville, Tenn., 25 Oct. 1977
(Contract EY-76-C-02-3073)
(CONF-771029-159) Avail: NTIS HC A02/MF A01

Cryocondensing panels will be used for the Neutral Beam Lines of the TFTR to satisfy a pumping speed requirement of 2,500,000 l/s. The cryocondensing panels are fed by liquid helium (LHe), boiling at selectable temperatures of 4.5 K or 3.8 K. Liquid nitrogen (LN2) panels and chevrons thermally shield the LHe panel. The closed-loop LHe supply system and the open loop LN2 system are discussed. The helium refrigerator of minimum 1070-W capacity, together with its distribution system, and the nitrogen distribution system in the ton/hour LN2 range is presented. Problems and their solutions in connection with the LH2 system, and the economies of various types of distribution lines (passive, pumped, shielded, combined), are described. Design features and auxiliary equipment to assure dispersion of large quantities of nitrogen into the atmosphere and to permit operation under degraded cryogenic helium refrigerator performance are also discussed. ERA

N78-25942# Grumman Aerospace Corp., Bethpage, N.Y.
REMOTE LEAK DETECTION FOR THE TFTR
C. R. Walthers 1977 4 p ref Presented at the 7th Symp. on Fusion Res. Proj., Knoxville, Tenn., 25 Oct. 1977
(Contract EY-76-C-02-3073)
(CONF-771029-160) Avail: NTIS HC A02/MF A01

The planned design for the TFTR (Tokamak Fusion Test Reactor) remote leak detection system consists of a central console which controls the application of tracer gas to possible leak areas. Seals are tested by admitting tracer gas to machined cavities on the atmospheric side of the seal. The tracer gas is

brought to the seal cavity by 1/8 inch diameter tubes which connect to local tracer gas/vacuum manifolds located outside the protective radiation shielding. Vacuum shell walls and welds are checked by flowing tracer gas through annular heating/cooling passages. The detector will be either an MSLD (mass spectrometer leak detector) or an RGA (residual gas analyzer), the location of which is not finalized. Feasibility tests performed and planned include response and sensitivity measurements of possible tubing/detector configurations with several tracer gases. ERA

N78-25943# Princeton Univ., N. J. Plasma Physics Lab.
NEOCLASSICAL CURRENT IN A TOROIDALLY-CONFINED MULTISPECIES PLASMA
S. P. Hirshman and A. H. Boozer Dec. 1977 44 p refs
(Contract EY-76-C-02-3073)
(PPPL-1409) Avail: NTIS HC A03/MF A01

The parallel current in a toroidally-conformed plasma is shown to generally consist of the current in response to the parallel electric field, the Pfirsch-Schluter current which is required by charge neutrality, and the bootstrap current which flows to maintain a balance between the viscous and friction forces along the magnetic field. The steady-state momentum equation is solved to obtain an expression for the parallel current in terms of the electric field and the neoclassical cross-field fluxes of particles and heat in a multiple ion species plasma. It is found that the presence of impurities does not alter the magnitude of the bootstrap current. Thus, the neoclassical beta limit established by the bootstrap current is insensitive to the impurity content of the plasma. The magnitudes of the bootstrap current and conjugate Ware fluxes are investigated in the transition from the long mean-free path to collisional regime. ERA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N78-25944*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
PRELIMINARY MEASUREMENTS OF QUALITY FACTORS OF MONOCRYSTALS
J.-P. Richard 20 Jun. 1978 12 p
(Grant NsG-5035)
(NASA-CR-157211) Avail: NTIS HC A02/MF A01 CSCL 20B

High Q's were obtained with silicon and sapphire crystals on four points mechanical suspensions. Instrumentation was developed to observe the approach to thermal equilibrium at cryogenic temperatures and to study thermal noise level and fluctuations. High Q crystals with low thermal noise level are promising candidates as high stability time references. Author

N78-25945# Colorado State Univ., Fort Collins. Dept. of Chemistry.
RAMAN SCATTERING OF NEAT AND MIXED CRYSTALS OF IRF6: THE JAHN-TELLER INTERACTION IN THE GROUND STATE
E. R. Bernstein and J. D. Webb Mar. 1978 33 p refs
(Contract N00014-75-C-1179)
(AD-A052754; TR-19) Avail: NTIS HC A03/MF A01 CSCL 20/10

Raman scattering data for neat and mixed crystal IrF6 samples at 77 K are reported. It is found that v(2)(eg) and v(5)(t2g) both evidence nonvanishing Jahn-Teller interactions for the gammA(8g)(4)A(2g) ground state. The linear Jahn-Teller parameters for these modes are D(2) - or = 0.001 and D(5) = 0.02. The v(5) Jahn-Teller interaction is large enough to quench an expected exciton splitting of approx. 1/20 cm almost completely. The v(2) Jahn-Teller interaction is small enough so that exciton interactions predominate; however, normal v(2) k = 0 sharp line exciton structure is not observed. Anomalous phonon behavior is observed and discussed with respect to other hexafluoride phonon data. The non-Jahn-Teller active modes v(1), v(3), v(4), v(6) are found to behave in a fashion consistent with other members of this series. Author (GRA)

N78-25946# Harry Diamond Labs., Adelphi, Md.
SEMICONDUCTOR DEVICE DAMAGE ASSESSMENT FOR THE INCA PROGRAM: A PROBABILISTIC APPROACH
Robert L. Williams Mar. 1978 22 p refs
(Contract MIPR-77-623)
(AD-A052433; HDL-TR-1833) Avail: NTIS HC A02/MF A01 CSCL 20/12

Two methods are described for estimating the probability that a given semiconductor device will be damaged by an electrical transient. Both methods are based on existing device damage data which were obtained by step-stressing devices to failure, using rectangular pulses. Both methods require calculation of the time-dependent power waveform in the device, due to application of the transient. One method employs only the largest peak of this power waveform, while the other includes the entire waveform in a convolution integral. Modifications to the DAMTRAC circuit-analysis program are presented. Author (GRA)

N78-25947# Ames Lab., Iowa.
CRYSTAL GROWTH WITH PARABOLIC INTERFACES
R. Trivedi Aug. 1977 23 p refs
(Contract W-7405-eng-82)
(IS-3939) Avail: NTIS HC A02/MF A01

A mathematical treatment is presented for the growth of dendrites or precipitates with parabolic interfaces. Two cases are considered in which the interfaces correspond to a paraboloid of revolution and a parabolic cylinder. For these interfaces, relationships between growth rate and supercooling are obtained for two general boundary conditions under the assumption that the temperature or concentration variation along the interface is finite and continuous. ERA

N78-25948# City Coll. of the City Univ. of New York. Dept. of Physics.
CALCULATIONS OF ENERGY SPECTRA FOR ESD OF H+ FROM H2 ADSORBED ON TUNGSTEN
Richard Janow and Narkis Tzoar 20 Apr. 1978 19 p refs
(Contract N00014-75-C-0949)
(AD-A053364; TR-78-01) Avail: NTIS HC A02/MF A01 CSCL 20/8

We calculated the kinetic energy distribution of H- ions desorbed from tungsten surfaces via ESD. Our calculations produced energy spectra consistent with experimental observation for several plausible atomic adsorption sites. Author (GRA)

N78-25949# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
ION IMPLANTED GaAs I. C. PROCESS TECHNOLOGY Quarterly Technical Report, 1 Sep. - 30 Nov. 1977
R. Zucca, F. H. Eisen, B. M. Welch, R. Eden, and R. D. Fairman Mar. 1978 67 p refs
(Contract F49620-77-C-0087; ARPA Order 3384)
(AD-A052894; SC5110.4QR; AFOSR-78-0672TR) Avail: NTIS HC A04/MF A01 CSCL 09/3

This report presents the second-quarter results of a program to develop an ion implanted planar GaAs integrated circuit process technology. The program involves three subcontractors (California Institute of Technology, Cornell University, and Crystal Specialties, Inc.) in addition to the Rockwell International Science Center. Work on growth of semi-insulating GaAs in this quarter has emphasized reduction of crystal plane slippage and dislocation density of GaAs crystals. The slippage problem has been considerably reduced by orienting the crystal growth in the -110= direction. Data have been obtained for high-dose selenium implants carried out at room temperature and annealed at 850 C and for room temperature silicon implants annealed at 850 C or 900 C. The mask set designed in the first quarter has been used in the fabrication of integrated circuits at the Science Center. A second layer interconnection process has been implemented. Devices and test circuits fabricated with the first mask set have been evaluated. Scaling of FET saturation currents with channel widths required for low power operation has been demonstrated down to a width of 1 micrometers. The Schottky diode FET logic gate designed for this first mask set has shown excellent low frequency performance. Measurements on seven stage ring oscillators utilizing 20 micrometers gate width FET NOR gates have given propagation delays as low as 82 picoseconds with approximately 2 mW/gate dissipation. GRA

N78-25950# Naval Research Lab., Washington, D. C. Electronics Technology Div.
CHARACTERIZATION OF 3-V MATERIALS Annual Summary Report, 1 Oct. 1976 - 30 Sep. 1977
Bruce D. McCombe Feb. 1978 108 p refs
(rf54582001)
(AD-A053308; NRL-MR-3701) Avail: NTIS HC A06/MF A01 CSCL 20/12

A program for the characterization of bulk and epitaxial single crystals of III-V compounds is described. The program includes electrical, chemical, structural and topographic characterization as well as device fabrication and evaluation, and is carried out on a co-ordinated basis by three Navy laboratories: The Naval Research Laboratory, the Naval Surface Weapons Center, and the Naval Ocean Systems Center. The primary goals of the effort continue to be: (1) to provide rapid and interactive feedback of routine characterization information to the materials growth effort, and (2) to develop new, innovative methods for materials characterization. Characterization techniques described include routine Hall effect measurements, photoconductivity, contactless microwave magnetoconductivity, contactless infrared optical measurements, photoluminescence of bulk and interface states, and fabrication and test of Schottky barrier field effect transistors. Results achieved with these techniques on GaAs and InP materials produced in-house and provided by commercial laboratories are described. Author (GRA)

N78-25951# Brookhaven National Lab., Upton, N. Y.
CHARGE DENSITY WAVE INSTABILITIES AND INCOMMENSURATE STRUCTURAL PHASE TRANSFORMATIONS
J. D. Axe Oct. 1977 29 p refs Presented at the Intern. Symp. on Neutron Inelastic Scattering, Vienna, 17 Oct. 1977
(Contract EY-76-C-02-0016)
(BNL-23330; Conf-771080-1) Avail: NTIS HC A03/MF A01

Incommensurate structural phase transformations involve the appearance of modulated atomic displacements with spatial periodicity unrelated to the fundamental periodicity of the basic lattice. In the case of some quasi one- or two-dimensional metals such transformations are the result of Fermi-surface instabilities that also produce electronic charge density waves (CDW's) and soft phonon modes due to metallic electron screening singularities. Incommensurate soft mode instabilities were found in insulators as well. Recent neutron scattering studies of both the statics and dynamics of incommensurate structural instabilities are reviewed. ERA

N78-25952# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
SUPERCONDUCTIVITY, MAGNETIC SUSCEPTIBILITY, AND ELECTRONIC PROPERTIES OF AMORPHOUS (Mo/SUB 1-x/Ru/SUB x/)180P20 ALLOYS OBTAINED BY LIQUID QUENCHING
W. L. Johnson, S. J. Poon, and P. Duwez Nov. 1977 43 p refs
(Contract EY-76-C-03-0822)
(CALT-822-99; ERDA-87) Avail: NTIS HC A03/MF A01

Results of X-ray diffraction, transmission electron diffraction, and crystallization studies on amorphous (Mo/sub 1-x/Ru/sub x/)80P20 alloys obtained by liquid quenching are presented and discussed. The alloys are all found to be superconducting with transition temperatures ranging from approximately 3 K to approximately 9 K. The variation of T/sub c/with alloy composition is compared to that obtained by Collver and Hammond for vapor quenched transition metal films. Results of magnetic susceptibility measurements are used to estimate the variation of the electronic density of states at the Fermi level, N(0), from the Pauli paramagnetic contribution. The relationship between the variation of T/sub c/ and N(0) is discussed in terms of the microscope theory of superconductivity. Finally, results of measurement of the upper critical field H/sub c2/ and the normal state electronic transport properties are presented and compared with recent theoretical models for amorphous superconductors. ERA

N78-25953# Ames Lab., Iowa.
MAGNETIC BEHAVIOR OF CURRENT-CARRYING TYPE-2 SUPERCONDUCTING CYLINDERS Ph.D. Thesis - Iowa State Univ.
M. L. Silber Feb. 1977 285 p refs
(Contract W-7405-eng-48)
(IS-T-751) Avail: NTIS HC A13/MF A01

The complex magnetic behavior of current-carrying superconducting cylinders in the presence of applied axial fields was investigated by accounting for critical current, surface pinning, and surface pitch angle, and by stressing the importance of the magnetic history of the sample. A differential equation was developed relating the thermodynamic field H(B) to the cylinder radius rho. The resultant flux profiles are integrated numerically to obtain the mean magnetization of the cylinder. Results are displayed using a phasdiagrammatic technique, which shows the relative amounts of axial and azimuthal field needed to produce a given field within the cylinder, as a function of the bulk pinning strength and the surface pitch angle. When simultaneously integrated, these equations yield a flux profile H(rho) which accounts for any arbitrary variations in the current and axial field experienced by the sample in progressing from the virgin state to the final flux configuration, provided the surface magnetic field increases with time. ERA

N78-25954# California Univ., Berkeley. Lawrence Berkeley Lab.
Ab INITIO EFFECTIVE CORE POTENTIALS INCLUDING RELATIVISTIC EFFECTS AND THEIR APPLICATION TO THE ELECTRONIC STRUCTURE CALCULATIONS OF HEAVY ATOMS AND MOLECULES Ph.D. Thesis
Yoon Sup Lee Nov. 1977 111 p refs
(Contract W-7405-eng-48)
(LBL-6962) Avail: NTIS HC A06/MF A01

The effects of the 4f shell of electrons and the relativity of valence electrons are compared. The effect of 4f shell (lanthanide contraction) is estimated from the numerical Hartree-Fock (HF) calculations of pseudo-atoms corresponding to Hf, Re, Au, Hg, Tl, Pb and Bi without 4f electrons with atomic numbers reduced by 14. The relativistic effect estimated from the numerical Dirac-Hartree-Fock (DHF) calculations of those atoms is comparable in the magnitude with that of the 4f shell of electrons. Both are larger for 6s than for 5d or 6p electrons. The various relativistic effects on valence electrons are discussed in detail to determine the proper level of the approximation for the valence electron calculations of systems with heavy elements. An effective core potential system has been developed for heavy atoms in which relativistic effects are included in the effective potentials. ERA

N78-25955# Sandia Labs., Albuquerque, N. Mex.
ION IMPLANTATION RANGE AND ENERGY DEPOSITION CODES COREL, RASE4, AND DAMG2
D. K. Brice Jul. 1977 115 p refs
(Contract EY-76-C-04-0789)
(SAND-75-0622) Avail: NTIS HC A06/MF A01

The FORTRAN codes COREL, RASE4 and DAMG2 can be used to calculate quantities associated with ion implantation range and energy deposition distributions within an amorphous target, or for ions incident far from low index directions and planes in crystalline targets. The basic theory behind these routines is discussed. The codes, listings, and complete instructions for their use are given and their limitations are examined. ERA

N78-25956# Oak Ridge National Lab., Tenn.
ANOMALOUS Au(111) SURFACES STUDIES BY LEED, AES, AND OXYGEN CHEMISORPTION
D. M. Zehmner and J. F. Wendelken 1977 5 p refs Presented at the 7th Intern. Vac. Congr. and 3d Intern. Conf. on Solid Surfaces, Vienna, Austria, 12 Sep. 1977
(Contract W-7405-eng-26)
(CONF-770908-5) Avail: NTIS HC A02/MF A01

LEED patterns obtained from clean Au(111) surfaces, show that each integral order diffraction beam in the normal (1 x 1) pattern is surrounded by hexagonal arrays of reflections aligned along the [110]. The spacing between these additional diffraction features is approximately 4 percent of that between the integral order beams and leads to the suggestion that the outermost layer of atoms is not completely coherent with respect to the bulk structure. Oxygen was found to adsorb on the clean surface at sample temperatures above 500 C but its presence did not affect the LEED pattern. An increased rate of adsorption was observed on surfaces which contained small quantities of Ca.

This chemisorbed oxygen could be removed by ion bombardment but not by heating up to 800 C. ERA

N78-25957# Los Alamos Scientific Lab., N. Mex.
THE ALPHA-GAMMA PHASE TRANSITIONS IN Ce-Th ALLOYS UNDER HIGH PRESSURE
C. Y. Huang, J. L. Smith, C. W. Chu (Cleveland State Univ., Ohio), and P. H. Schmidt (Bell Labs., Murray Hill, N. J.) 1977 26 p refs Presented at Intern. Conf. on High Pressure and Low Temp. Phys., Cleveland, 20-22 Jul. 1977 Sponsored in part by NSF
(Contract W-7405-eng-36)
(LA-UR-77-2153; Conf-770722-4) Avail: NTIS HC A03/MF A01

For a given x, the temperature of the alpha-gamma transition in Ce/sub 1-x/th/sub x/ increases linearly with pressure. For a given x, larger than x/sub c/, the divergence of dR/dT decreases with increasing pressure and causes broader peaks. The critical exponents, where they could be extracted, were always less than the mean field value of 3 under any applied pressure. The shift of the transition temperature with pressure (dT/sub c//dP) decreases with increasing x until it levels off near the critical concentration, x/sub c/. These results point out that x and P cannot be taken to be thermodynamically equivalent and that the transition does not appear to be a mean field type for P greater than or equal to 0. ERA

N78-25958# Argonne National Lab., Ill.
FERMI SURFACE, FERMI VELOCITY, AND ELECTRON-PHONON INTERACTION PARAMETER IN Nb
D. H. Dye (Northwestern Univ., Evanston, Ill.), D. P. Karim (Northwestern Univ., Evanston, Ill.), J. B. Ketterson (Northwestern Univ., Evanston, Ill.), and G. W. Crabtree 1977 13 p refs Presented at Intern. Conf. on Physics of Transition Metals, Toronto, 15 Aug. 1977
(Contract W-31-109-eng-38; Grant NSF DMR-76-21370)
(CONF-770827-7) Avail: NTIS HC A02/MF A01

A Korringa-Kohm-Rostoker band structure formalism was used to fit external areas and effective masses obtained from de Haas-van Alphen measurements by using the appropriate cubic scattering phase shifts and their energy derivatives as disposable parameters. The resulting Fermi radii and velocities in the (100) and (110) planes are presented for all sheets of the Fermi surface. When the velocities are compared with augmented-plane-wave calculations, a local enhancement factor is deduced. ERA

N78-25959# Ames Lab., Iowa.
VALENCE BANDS OF Cr-RICH-Cr ALLOYS DETERMINED BY X-RAY PHOTOELECTRON SPECTROSCOPY M.S. Thesis - Loyola Univ.
J. A. Galt Dec. 1977 49 p refs
(Contract W-7405-eng-82)
(IS-T-794) Avail: NTIS HC A03/MF A01

The valence bands of Cr-rich Fe-Cr alloys were examined by X-ray photoelectron spectroscopy for the possible existence of a virtual bound state. Samples containing 1%, 4%, 12%, and 21% Fe were tested and compared with a theoretical calculation based on the VBS model. Final results showed a trend possibly indicative of a VBS in this system, but further data of higher resolution are needed for quantitative results. ERA

N78-25960# Marquette Univ., Milwaukee, Wis. Coll. of Engineering.
STUDY OF THE DEFECT STRUCTURE OF PURE AND DOPED NONSTOICHIOMETRIC CeO2 Final Report, 1 Jan. 1965 - 31 May 1977
R. N. Blumenthal Nov. 1977 19 p refs
(Contract EY-76-S-02-1441)
(COO-1441-28) Avail: NTIS HC A02/MF A01

The defect structure and transport properties of defects in nonstoichiometric oxides were studied based on their electrical and thermodynamic behavior. Similar studies were also made on doped-nonstoichiometric oxides to determine the effect of the ionic radii, valence and concentration of the dopant cation on the nonstoichiometric defect structure and the transport properties of these defects. The thermodynamic and electrical property study on pure and doped-nonstoichiometric CeO2/sub -x/ is reviewed. The combined study of the electrical conductivity, ionic transference, and thermodynamic measurements initiated on CaO-doped CeO2 as a function of temperature, oxygen pressure and CaO content is discussed. The results of similar measurements on CeO2 doped with other oxides (e.g., ThO2, Ta2O5, etc.) which have cations with different valences and ionic radii are also discussed. ERA

N78-25961# Sandia Labs., Albuquerque, N. Mex.
ALMOST ALL n-DIMENSIONAL RECTANGULAR LATTICES ARE HAMILTON-LACEABLE
G. J. Simmons 1977 13 p refs Presented at the 9th Southeastern Conf. on Combinatoric Graph Theory and Computing, Boca Raton, Fla., 30 Jan. 1978
(Contract EY-76-C-04-0789)
(SAND-77-1670C; Conf-780105-1) Avail: NTIS HC A02/MF A01

A bipartite graph G with vertex sets V sub 1 and V sub 2 is defined to be Hamilton laceable if: (1) absolute value V sub 1 = absolute value V sub 2 and for every p as an element of V sub 1 and 1 as an element of V sub 2, or else (2) absolute value V sub 1 = absolute value V sub 2 + 1 for every p,q as an element of V sub 1, p not equal to q, there exists a Hamilton path in G with endpoints p and q. It is shown that all n-dimensional rectangular lattices are Hamilton laceable except for the two-dimensional lattices: (1) 2 x m, m not equal to 2, and (2) 3 x 2 m. ERA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N78-25962# Utah Univ., Salt Lake City. Dept. of Mechanical Engineering.
COMPUTER PROGRAM FOR DETERMINING THE THERMODYNAMIC PROPERTIES OF FREON REFRIGERANTS
David H. Riemer, Harold R. Jacobs, and Robert F. Boehm Dec. 1977 105 p refs
(Contract EY-76-S-07-1523; Grant NSF AER-75-01039)
(UTEC-ME-76-212) Avail: NTIS HC A06/MF A01

A subroutine for determining F-11, F-12, F-13, F-14, F-21, F-22, F-23, F-113, and F-114 was written. The program can evaluate a thermodynamic state for these refrigerants given any of the following pairs of state quantities; pressure and quality; pressure and entropy; pressure and enthalpy; temperature and quality; temperature and specific volume; and temperature and pressure. These six pairs of knowns allow the user to analyze any thermodynamic cycle utilizing a refrigerant as the working fluid. The Downing form of the Martin equation of state was used. A flow chart is presented along with a listing of all subroutines required. ERA

N78-25963# Sandia Labs., Albuquerque, N. Mex.
PICACS
R. T. Walsh Nov. 1977 67 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0072) Avail: NTIS HC A04/MF A01

The Solid Mechanics Research Department is consolidating several plotting routines, which support individual continuum mechanics programs, into a single, integrated system. As part of the design of the user interface, the input instructions, for batch mode were specified. They are presented here in the form of a users manual. ERA

N78-25964# Columbia Univ., New York. Liquid Metals Research Lab.
HIGH TEMPERATURE PROPERTIES OF NUCLEAR REACTOR COOLANTS AND THERMODYNAMIC POWER CYCLE WORKING FLUIDS Technical Progress Report, 1 Dec. 1976 - 30 Oct. 1977
C. F. Bonilla Aug. 1977 37 p refs

(Contracts EY-76-S-02-3027; EY-77-S-02-3027)
(COO-3027-30) Avail: NTIS HC A03/MF A01

New data on compressibility and expansivity of molten sodium were obtained, several other property values were refined and/or prepared for distribution, and brief programs previously planned and initiated on surface tension and incipient cavitation damage were continued. The program already commenced on high temperature properties of lithium as a coolant for fusion reactors yielded its first results as vapor pressure data up to 1965 K. A new apparatus for the surface tension of lithium, important in heat pipe design, etc., was designed and initially tested in the sodium program. Partially supported programs on development of a physical mechanism for transition boiling, useful in emergency core cooling and blow-down analyses, was continued, and the thermal conductivity study of saturated and superheated mercury vapor up to 1000 C and 3200 psia was completed. ERA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N78-25965# National Technical Information Service, Springfield, Va.
VOCATIONAL EDUCATION AND TRAINING FOR THE NON-HANDICAPPED. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Mar. 1978
Mary E. Young Apr. 1978 194 p Supersedes NTIS/PS-77/0254; NTIS/PS-76/0205
(NTIS/PS-78/0315; NTIS/PS-77/0254; NTIS/PS-76/0205) Avail: NTIS HC $28.00/MF $28.00 CSCL 05I

The reports abstracted cover development, planning, and impact of vocational training programs aimed at the hard-core unemployed or socially or economically disadvantaged. Included are evaluations of technical schools or curricula from the standpoint of industry's needs, as well as from the standpoint of the individual. GRA

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N78-25966*# City Coll. of the City Univ. of New York.
AN ADAPTIVE LEARNING CONTROL SYSTEM FOR AIRCRAFT
Ralph Mekel and Solomon Nachmias Apr. 1978 222 p refs (Grant NsG-1169)
(NASA-CR-156930) Avail: NTIS HC A10/MF A01 CSCL 05A

A learning control system and its utilization as a flight control system for F-8 Digital Fly-By-Wire (DFBW) research aircraft is studied. The system has the ability to adjust a gain schedule to account for changing plant characteristics and to improve its performance and the plant's performance in the course of its own operation. Three subsystems are detailed: (1) the information acquisition subsystem which identifies the plant's parameters at a given operating condition; (2) the learning algorithm subsystem which relates the identified parameters to predetermined analytical expressions describing the behavior of the parameters over a range of operating conditions; and (3) the memory and control process subsystem which consists of the collection of updated coefficients (memory) and the derived control laws. Simulation experiments indicate that the learning control system is effective in compensating for parameter variations caused by changes in flight conditions. Author

N78-25967# Water Research Commission, Pretoria (South Africa).
MODERN THINKING IN WASTE WATER MANAGEMENT
G. J. Stander [1977] 13 p
Avail: NTIS HC A02/MF A01

An overall review of wastewater management in South Africa is presented. Several topics of discussion are: (1) changing quality of water; (2) water quality criteria; (3) national water quality network; (4) health aspects; (5) epidemiology studies-health hazards; and (6) domestic use of reclaimed water--public acceptance, criteria for plant design. G.Y.

N78-25968# General Research Corp., Santa Barbara, Calif.
COST REPORTING ELEMENTS AND ACTIVITY COST TRADE-OFFS FOR DEFENSE SYSTEM SOFTWARE. VOLUME 2: EXECUTIVE SUMMARY Final Report, 11 Mar. 1976 - 11 Mar. 1977
C. A. Graver, W. M. Carriere, E. E. Balkovich, and R. Thibodeau May 1977 65 p refs 2 Vol.
(Contract F19628-76-C-0180)
(AD-A053021; CR-1-721-Vol-2; ESD-TR-77-262-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 09/2

This technical report examines the costs of developing and maintaining computer software for major defense systems. A process model is described which depicts the relations among activities and phases of the software life cycle, identifies the product and cost information that is normally available, and specifies the milestones. This process model is normally used as the basis for selecting the elements of a software cost reporting system. The suggested reporting system also includes descriptions of the final product, time phasing of product development, a standardized list of Computer Program Components, and a standardized list of labor categories. During the study, data was collected from several sources including the following Air Force organizations: Electronic Systems Division, Aeronautical Systems Division, Space and Missile Systems Organization, and Data Systems Design Center. Cost estimating relationships for each phase of the software life cycle are explored, using the process model and the data. The importance of trade-offs in cost between phases is demonstrated. The report also contains estimating relationships for evaluating the cost effects of software size, computer capacity constraints, programming language, and changes in requirements. It also addresses the separation of two activities, error correction and product improvement, during the maintenance phase of the life cycle. Results are integrated with other software cost estimating techniques. Author (GRA)

N78-25969# University City Science Center, Philadelphia, Pa.
THE ROLE OF CONSORTIA IN THE NATIONAL R AND D EFFORT Final Report
Francis W. Wolek Jul. 1977 269 p refs
(Grants NSF PRA-74-02411)
(PB-277366; NSF/PRA-7402411/1/8) Avail: NTIS HC A12/MF A01 CSCL 05A

A study of one form of supporting industrial R&D in the United States: industrially sponsored consortia is presented. The report presents findings on the size of the R&D programs of consortia, their location, their nature, and their value. These and other results were sought for the light they would shed on the policy of government toward consortia. GRA

N78-25970# Defense Systems Management School, Fort Belvoir, Va.
DOCTRINE VERSUS CAPABILITIES: A PROJECT MANAGER'S DILEMMA WITH THE CH-47 HELICOPTER
Billy V. Genter Nov. 1977 37 p refs
(AD-A052376; PMC-77-2) Avail: NTIS HC A03/MF A01 CSCL 01/3

This report examines an existing dilemma facing the CH-47 Modernization PM. The dilemma is the conflict between the tactical doctrine and the CH-47 external load capabilities, including the near term modernized capabilities. The external load limitations are defined and future technology to improve the CH-47 capabilities is identified. Two promising external load carrying concepts are highlighted. The primary recommendation is for the user to question if the external load NOE, all weather, day-night capability is a valid requirement. Author (GRA)

N78-25971# General Research Corp., Santa Barbara, Calif.
COST REPORTING ELEMENTS AND ACTIVITY COST TRADEOFFS FOR DEFENSE SYSTEM SOFTWARE. VOLUME 1: STUDY RESULTS Final Report, 11 Mar. 1976 - 11 Mar. 1977
C. A. Graver, W. M. Carriere, E. E. Balkovich, and R. Thibodeau May 1977 299 p refs 2 Vol.

(Contract F19628-76-C-0180)
(AD-A053020; CR-1-721-Vol-1; ESD-TR-77-262-Vol-1) Avail: NTIS HC A13/MF A01 CSCL 09/2

In April 1976, General Research Corporation (GRC) began a study of 'Life-Cycle Costing of Major Defense System Software and Computer Resources,' Contract F19628- 76-C-0180. The purpose was to assist Air Force Program Offices and staff agencies in estimating, reporting and controlling the life-cycle costs of software. The study was performed under direction of the Electronic Systems Division (AFSC), Computer Systems Engineering Office (TOI). GRA

N78-25972# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
AIR FORCE TECHNICAL OBJECTIVE DOCUMENT FISCAL YEAR 1979
Vincent Donlan Dec. 1977 31 p Supersedes AFML-TR-76-228, AD-A045303
(AD-A053340; AFML-TR-77-200; AF-A045303; AFML-TR-76-228) Avail: NTIS HC A03/MF A01 CSCL 15/3

This Technical Objective Document was prepared by the Air Force Materials Laboratory (AFML) and describes the Materials Technology Areas for meeting future Air Force operational needs. The six Technology Areas encompass the full spectrum of materials capabilities required for future aircraft, missile, space, and electronic systems - Thermal Protection Materials; Aerospace Structural Materials; Aerospace Propulsion Materials; Fluid, Lubricant, and Elastomeric Materials; Protective Coatings and Materials, and Electromagnetic Windows and Electronics. Presented for each TA is the general objective, specific goals, technical approaches, and a Laboratory TA focal point who can facilitate face-to-face discussions with Laboratory engineers and scientists. Author (GRA)

N78-25973# Massachusetts Inst. of Tech., Cambridge. Operations Research Center.
THE MULTI-PRODUCT PRODUCTION CYCLING PROBLEM: DEVELOPMENT OF HEURISTICS
Stephan C. Graves Mar. 1978 27 p refs
(Contract N00014-75-C-0556)
(AD-A053243; TR-16) Avail: NTIS HC A03/MF A01 CSCL 15/5

The multi-product production cycling problem is concerned with the determination of a production/inventory policy for a single capacitated production facility which is dedicated to producing a family of products. This paper studies this problem assuming stochastic demand. The one-product problem is formulated as a Markov decision problem which may be reasonably solved. For the multi-product problem, heuristic decision rules are proposed. In the context of an identical-product problem, we develop a heuristic decision policy which is based on the analysis of the one-product problem, and on two new notions: the composite product and the lead-time adjustment. This heuristic is then extended to the identical-cost problem, and the correlated demand problem. Arguments are presented for the generality of the identical-cost problem, and hence the generality of the proposed heuristic policy. Author (GRA)

N78-25974# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A STUDY OF THE F-4 PROGRAM MANAGEMENT RESPONSIBILITY TRANSFER (PMRT) FROM THE AIR FORCE SYSTEMS COMMAND TO THE LOGISTICS COMMAND M.S. Thesis
Wesley K. Darrell Dec. 1977 155 p refs
(AD-A052903; AFIT/GSM/SM/77D-19) Avail: NTIS HC A08/MF A01 CSCL 01/3

The increasing costs of weapon systems have created a demand for more efficient program management. The Air Force organizational structure for acquiring and supporting weapon systems results in two commands sharing this responsibility. The Air Force Systems Command is responsible for research, development, procurement, and production. The Air Force Logistics Command is responsible for supply, maintenance, and other logistical support. Program management responsibility transfers from the Systems Command to the Logistics Command at some point in the acquisition cycle. This transition has, in the past, resulted in confusion, duplication, and fragmented responsibility. In an effort to provide for more efficient program management during program transition, the Program Management Responsibility Transfer concept was initiated in 1975. The F-4 program was the first program to transfer under this new concept. The purpose of this study is to provide a critical analysis of the new transfer process through a study of the F-4 transfer. GRA

N78-25975# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
PRODUCTIVITY IN THE AIR FORCE WEAPONS LABORATORY: MEASUREMENT AND PREDICTION
Michael J. Stahl Jan. 1978 23 p refs
(AD-A052897; AFIT-TR-78-1) Avail: NTIS HC A02/MF A01 CSCL 05/9

Productivity in the Air Force Weapons Laboratory was measured with eight separate kinds of output, an unweighted total, and a weighted total measure of output for 135 scientists/engineers. Several individual and organizational variables were also captured. Educational level, communication with other scientists and engineers, attendance at professional society meetings, office membership, and reward contingency perceptions predicted productive vice nonproductive respondents. A discovered lack of consensus between supervisors and nonsupervisors concerning the importance of technical reports was hypothesized to be attributable to differences between the stated and the perceived reward system. Author (GRA)

N78-25976# California Univ., Livermore. Lawrence Livermore Lab.
SYSTEM EFFECTIVENESS OF MATERIAL CONTROL AND ACCOUNTING SYSTEMS
J. W. Lathrop, L. R. Spogen, and R. W. Adams 1977 9 p refs Presented at Symp. on Systems and Decision Sci., Berkeley, Calif., 2 Oct. 1977
(Contract W-7405-eng-48)
(UCRL-80336; Conf-771005-4) Avail: NTIS HC A02/MF A01

A methodology that will assist the NRC in evaluating material control and accounting systems is described. The major features of the methodology are described, with an emphasis on the decision analytic issues involved. A key problem is the estimation of the relative likelihood of adversary actions. Some approaches to the solution of this problem are discussed. ERA

N78-25977 National Technical Information Service, Springfield, Va.
LABOR RELATIONS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1975 - Apr. 1978
Mary E. Young Apr. 1978 178 p Supersedes NTIS/PS-77/0281; NTIS/PS-76/0253; NTIS/PS-75/290
(NTIS/PS-78/0325; NTIS/PS-77/0281; NTIS/PS-76/0253; NTIS/PS-75/290) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 05I

Cited studies include labor problems, effects of labor unions, labor-management relationships, labor attitudes, attitudes of business towards labor, minority problems, and the cause and effect of labor migration and turnover on business and the economy. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N78-25978*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PUBLICATIONS OF THE JET PROPULSION LABORATORY, 1977
1 May 1978 172 p refs
(Contract NAS7-100)
(NASA-CR-157186; JPL-Bibl-39-19) Avail: NTIS HC A08/MF A01 CSCL 05B

This bibliography cites 900 externally distributed technical reports released during calendar year 1977, that resulted from scientific and engineering work performed, or managed, by the Jet Propulsion Laboratory. Report topics cover 81 subject areas related in some way to the various NASA programs. The publications are indexed by: (1) author, (2) subject, and (3) publication type and number. A descriptive entry appears under the name of each author of each publication; an abstract is included with the entry for the primary (first-listed) author.

Author

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N78-25979*# Stanford Univ., Calif. Dept. of Civil Engineering.

AIR FREIGHT DEMAND MODELS: AN OVERVIEW

Jarir S. Dajani and Gerald W. Bernstein May 1978 31 p refs

(NCAZ-OR745-720)

(NASA-CR-152148) Avail: NTIS HC A03/MF A01 CSCL 05C

A survey is presented of some of the approaches which have been considered in freight demand estimation. The few existing continuous time computer simulations of aviation systems are reviewed, with a view toward the assessment of this approach as a tool for structuring air freight studies and for relating the different components of the air freight system. The variety of available data types and sources, without which the calibration, validation and the testing of both modal split and simulation models would be impossible are also reviewed. Author

N78-25980# Bradford National Corp., Rockville, Md.

FINANCIAL INCENTIVES RESEARCH AND LENDING MARKET IMPACT ANALYSIS

Russell F. Smith, Patricia S. Bryant, Edward E. Cour, and Paul C. Kouchoukos Nov. 1977 92 p refs

(Contract EX-76-C-10-3866)

(HCP/M3866-1) Avail: NTIS HC A05/MF A01

The U.S. Energy Research and Development Administration is authorized by recent legislation to enter into loan guaranty and interest assistance agreements related to specific energy programs. These loan guaranty programs are designed to encourage the private sector to participate in the development of alternative energy sources and the conservation of energy. Two programs are currently authorized: one dealing with geothermal energy; the other dealing with electric and hybrid vehicles. An introductory overview provides a brief summary of: energy legislation, ERDA loan guaranty programs, basis of and purpose for the investigation, and scope. Subsequent sections of this report address related background information; methodology employed; data collection, and analysis of the information obtained; and specific recommendations based upon the results of the analysis. ERA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N78-25981# Committee on Appropriations (U. S. Senate).

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, INDEPENDENT AGENCIES APPROPRIATION ACT, 1979

Washington GPO 1978 36 p H.R. 12936 referred to the Comm. on Appropriations, 95th Congr., 2d Sess., 22 Jun. 1978 Avail: US Capitol, Senate Document Room

An Act, H.R. 12936, outlining the appropriations for the Department of Housing and Urban Development, and for sundry independent agencies, boards, commissions, corporations, and offices for the fiscal year ending September 30, 1979, and for other purposes is presented. G.Y.

N78-25982# George Washington Univ., Washington, D. C.

LEGAL-INSTITUTIONAL ARRANGEMENTS FACILITATING OFFSHORE WIND ENERGY CONVERSION SYSTEMS (WECS) UTILIZATION Final Report

Louis H. Mayo Sep. 1977 103 p refs Sponsored by DOE

(Grant NSF APR-75-19137)

(DOE/NSF/19137-77/3) Avail: NTIS HC A06/MF A01

Concern for the continuing sufficiency of energy supplies in the U.S. has tended to direct increasing attention to unconventional sources of supply, including wind energy. Some of the more striking proposals for the utilization of wind energy relate to offshore configurations. The legal-institutional arrangements for facilitating the utilization of offshore wind energy conversion systems were examined by positioning three program alternatives and analyzing the institutional support required for the implementation of each. Author

N78-25983# George Washington Univ., Washington, D. C. Program of Policy Studies in Science and Technology.

LEGAL-INSTITUTIONAL IMPLICATIONS OF WIND ENERGY CONVERSION SYSTEMS (WECS) Final Report

Sep. 1977 332 p refs Sponsored in part by DOE

(Grant NSF APR-75-19137)

(NSF/RA-770204) Avail: NTIS HC A15/MF A01

Because of the interplay between technical, economic, social, and legal factors, some information about wind systems, their likely applications, and the problems raised thereby is presented. The most significant legal obstacles to the utilization of land-based WECS are described. The features of the existing legal structure which may facilitate the implementation of such systems are discussed. The ways in which the legal situation varies with particular applications, and which applications pose the greatest and fewest legal difficulties are summarized. A separate section is devoted to the complex subject of offshore wind systems.

ERA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N78-25984# Department of the Environment, Stevenage (England).

ADVANCED WASTEWATER TREATMENT IN THE UNITED KINGDOM: THE DOE PROJECT

Roy Best and Noel Banks [1977] 31 p refs Presented at Intern. Conf. on Advanced Treatment and Reclamation of Wastewater

Copyright. Avail: Issuing Activity

The United Kingdom's water supply, sewage treatment and discharge conditions are reviewed briefly. The emerging needs for new treatment methods and standards are suggested. The various plants and studies comprising the DOE Project are described in detail and are illustrated by diagrams and photographs. Leading results are expressed graphically. A comparative economic evaluation of traditional and advanced treatment methods is made and likely trends for future work are postulated. Author

N78-25985*# United Technologies Research Center, East Hartford, Conn.

APPLICATIONS OF ADVANCED TRANSPORT AIRCRAFT IN DEVELOPING COUNTRIES Contractor Report, Mar. 1977 - Apr. 1978

F. W. Gobetz, R. J. Assarabowski, and A. A. LeShane May 1978 340 p refs

(Contract NAS1-14795)

(NASA-CR-145343; R78-912839-14) Avail: NTIS HC A15/MF A01 CSCL 05A

Four representative market scenarios were studied to evaluate the relative performance of air-and surface-based transportation

systems in meeting the needs of two developing contries, Brazil and Indonesia, which were selected for detailed case studies. The market scenarios were: remote mining, low-density transport, tropical forestry, and large cargo aircraft serving processing centers in resource-rich, remote areas. The long-term potential of various aircraft types, together with fleet requirements and necessary technology advances, is determined for each application. Author

N78-25986*# Delco Electronics, Santa Barbara, Calif.
ELECTROMECHANICAL FLIGHT CONTROL ACTUATOR, VOLUME 2 Final Report
Jan. 1978 192 p 3 Vol.
(Contract NAS9-14952)
(NASA-CR-151734; R78-1-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 13F

Schematic diagrams are given for both the four-channel electromechanical actuator and the single-channel power electronics breadboard. Detailed design data is also given on the gears used in the differential gearbox and a copy of the operations manual for the system is included. Performance test results are given for the EMA motor and its current source indicator, the drive control electronics, and the overall system. The power converter waveform test results are also summarized. Author

N78-25987*# Delco Electronics, Santa Barbara, Calif.
ELECTROMECHANICAL FLIGHT CONTROL ACTUATOR, VOLUME 3 Final Report
Jan. 1978 188 p 3 Vol.
(Contract NAS9-14952)
(NASA-CR-151735; R78-1-Vol-3) Avail: NTIS HC A09/MF A01 CSCL 13F

The design verification tests which were conducted on the electromechanical actuator are described. A description is also given of the power components tests which were conducted to aid in selecting the power transistors for use in the single-channel power electronics breadboard and the results of tests which were conducted on the power electronics breadboard. Author

N78-25988*# Ford Motor Co., Dearborn, Mich.
CERAMIC REGENERATOR SYSTEMS DEVELOPMENT PROGRAM Progress Report, 1 Oct. 1976 - 30 Sep. 1977
J. A. Cook, C. A. Fucinari, J. N. Lingscheit, and C. J. Rahnke
Dec. 1977 129 p refs Prepared for DOE
(Contract DEN-3-8)
(NASA-CR-135330; CONS/0008-1) Avail: NTIS HC A07/MF A01 CSCL 13F

Ceramic regenerator cores are considered that can be used in passenger car gas turbine engines, Stirling engines, and industrial/truck gas turbine engines. Improved materials and design concepts aimed at reducing or eliminating chemical attack were placed on durability test in Ford 707 industrial gas turbine engines. The results of 19,600 hours of turbine engine durability testing are described. Two materials, aluminum silicate and magnesium aluminum silicate, continue to show promise toward achieving the durability objectives of this program. A regenerator core made from aluminum silicate showed minimal evidence of chemical attack damage after 6935 hours of engine test at 800 C and another showed little distress after 3510 hours at 982 C. Results obtained in ceramic material screening tests, aerothermodynamic performance tests, stress analysis, cost studies, and material specifications are also included. Author

N78-25989# Watson (J. D. and D. M.) Consulting Engineers, London (England).
THE TREATMENT OF AN INDUSTRIAL EFFLUENT FROM THE MANUFACTURE OF ORGANIC CHEMICALS FOR PROCESS REUSE
John M. Sidwick [1977] 8 p ref Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

A controlled program of sampling, analysis, and flow measurement was coupled with a parallel study of the mixed trade effluent in order to try to establish a mass balance across the factory. A reasonable correlation was achieved between internal waste and mixed effluent data and, while wide variations in mixed effluent characteristics were confirmed to be present, the mixed effluent was shown to have a COD strength of about 2,000 mg/l and a BOD of about 900 mg/l; much of this organic load was due to the presence of relatively high concentrations of solvents. Author

N78-25990# Vanderbilt Univ., Nashville, Tenn.
TECHNICAL CONSIDERATIONS OF BIOLOGICAL, PHYSICAL AND CHEMICAL TREATMENT COMBINATIONS FOR IMPROVED EFFLUENT QUALITY FROM INDUSTRIAL WASTEWATERS
W. Wesley Eckenfelder, Jr. [1977] 16 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

Some results on the advanced treatment of industrial wastewaters are summarized. Activated sludge studies were conducted on an organic chemicals wastewater containing a pesticide with and without pre-carbon treatment of the pesticide stream. The activated sludge process is considered as the biological treatment method. The secondary effluents are then treated physically and chemically to remove other pollutants not removed by the activated sludge process. These treatments include: (1) Filtration - to remove suspended solids; (2) Denitrification - to remove BOD; (3) Ozonation and chlorination - to remove color and residual refractory organics; and (4) Carbon adsorption - used for the same purpose as ozonation and chlorination in addition to removing trace quantities of heavy metals. G.Y.

N78-25991# Johannesburg City Council (South Africa).
OPTIMISATION OF THE JOHANNESBURG OLIFANTSVLEI EXTENDED AERATION PLANT FOR PHOSPHORUS REMOVAL
S. L. V. Venter, J. Halliday, and A. R. Pittman [1977] 20 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

The adaption of a 100 M lambda d extended aeration plant for biological phosphorus removal without chemical addition is described. The results indicate that an effluent with an average soluble phosphorus concentration of 1 mg P lambda can be obtained. Removal of phosphorus in the activated sludge process is stimulated by creating anoxic/anaerobic conditions at the inlet end of the process. Suggestions for possible modifications to the plant are made. Author

N78-25992# Johannesburg City Council (South Africa).
OPTIMISATION OF THE ACTIVATED SLUDGE PROCESS FOR THE BIOLOGICAL REMOVAL OF PHOSPHOROUS
D. W. Osborn and H. A. Nicholls [1977] 24 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

Biological uptake of phosphorus in activated sludge plants in excess of normal metabolic requirements is attributable to storage of polyphosphate by the overplus mechanism. Requirements for optimal performance appear to be that the MLSS must be exposed to a condition of anaerobiasis under nutrient limiting conditions and in the absence of nitrates. Author

N78-25993# Water Research Centre, Stevenage (England).
KINETICS OF DENITRIFICATION IN THE ACTIVATED-SLUDGE PROCESS
A. R. Paskins, G. L. Jones, and A. B. Wheatland [1977] 8 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

Experiments with activated sludge under anoxic conditions have shown that the rate of denitrification with identical initial concentrations of carbon differs according to the nature of the carbon source. Maximum rates of removal of nitrate with methanol, glucose and peptone as carbon sources were 2.3, 2.9 and 9.3 mg N/g sludge h respectively. Author

N78-25994# Wastewater Technology Centre, Burlington (Ontario). Dept. of Fisheries and Environment.
KINETIC STUDIES OF SINGLE SLUDGE NITROGEN REMOVAL SYSTEMS
Paul M. Sutton, Keith L. Murphy (McMaster Univ.), and Bruce E. Jank [1977] 15 p refs Presented at the Intern. Conf. on

Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

Design approaches are outlined for nitrification in combined and separate activated sludge systems and for denitrification in separate sludge systems receiving an external carbon and energy source. The information resulting from the operation of four different combined sludge systems indicated that the degree of nitrification is dependent on the solids retention time in the aerobic reactors. The design of anoxic reactors for denitrification can be determined by specifying the unit denitrification rate. No difference is found between the temperature sensitivity of nitrification and denitrification in combined and separate sludge systems. Author

N78-25995# Stadtentwaesserung, Hamburg (West Germany).
LOCATION, CONTROL AND DISPOSAL OF LIQUID WASTES FROM TRADE AND INDUSTRY IN THE FEDERAL REPUBLIC OF GERMANY
Ernst Kuntze [1977] 26 p Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A03/MF A01

A program for the treatment and disposal of industrial waste in the Federal Republic of Germany is outlined. The following topics are discussed: (1) definition of the terms waste and special waste; (2) legal regulations; (3) the primary location of special waste; (4) the influence of collected waste data on the planning for the future; (5) the invoice method; (6) execution of special disposal; (7) waste technology-collection points for special wastes, central treatment plants, incineration of special wastes, Land fill for special wastes, disposal at high seas, storage in underground fills; (8) cost of disposal; (9) personnel and the art of operation of special waste treatment. G.Y.

N78-25996# Clemson Univ., S.C. Environmental Systems Engineering.
THE ADVANCED WASTE TREATMENT ENGINEER AND PLANT OPERATIONS
John H. Austin [1977] 14 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

The success of an advanced water treatment facility is determined by the capability of its operating personnel. Suggestions are made for a systematic approach to defining the performance required by operating personnel and the development of instructional materials, O and M guides and trouble shooting manuals. Examples will be given of efforts along these lines. Author

N78-25997# National Inst. for Water Research, Pretoria (South Africa).
THE USE OF FISH AS A BIOLOGICAL SENSOR FOR TOXIC COMPOUNDS IN POTABLE WATER
W. S. G. Morgan [1977] 5 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

Rapid, continuous, biological monitoring systems were intended to complement physical-chemical surveillance, developed to utilize increases in fish opercular rhythms and activity. Any increase above the rates to be expected under normal conditions is monitored electronically. Built-in, visual alarm systems provide advance warning of imminent conditions that may be deleterious to public health. Author

N78-25998# National Inst. for Water Research, Pretoria (South Africa).
COMPARATIVE RECLAMATION OF POTABLE WATER FROM BIOFILTER AND ACTIVATED SLUDGE EFFLUENTS AT THE STANDER WATER RECLAMATION PLANT
S. H. V. vanBlerk, J. Prinsloo, and J. vanLeeuwen [1977] 9 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

The reclamation of water from biofilter humus tank effluent and activated sludge effluent by a physical-chemical process was studied at a 4,500 cu m d/1 water reclamation plant. Lime clarification followed by quality equalization, ammonia stripping, recarbonation, sand filtration, chlorination, active carbon adsorption, and chemical stabilization produced a high quality potable water from humus tank effluent. Water was reclaimed from activated sludge effluent utilizing the same process without quality equalization and ammonia stripping. The simplified process was easier to control and rendered a product water of comparable quality. In processing activated sludge effluent, consumption of chemicals was less and reclamation costs were reduced by 20 to 30%, depending on the size of the plant. Author

N78-25999# Mekoroth Water Co., Tel Aviv (Israel).
AMMONIA REMOVAL IN A POND SYSTEM AND IN A STRIPPING TOWER
M. Ronen and L. R. J. vanVuuren (Natl. Inst. for Water Res., Pretoria) [1977] 13 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

The mode of ammonia removal from ponds is described by a model of a first-order, chemical reaction, independently of the operational conditions of the pond system. Enhanced ammonia removal was observed at extended retention times owing to biological ammonia consumption. The stripping process is described by a correlation between the ammonia concentration reduction through the tower and the final ammonia concentration. Greater humidity in the inflowing air to the tower resulted in improved ammonia stripping. Author

N78-26000# National Inst. for Water Research, Pretoria (South Africa).
OPERATIONAL AND CONTROL ASPECTS IN WATER RECLAMATION
Oliver O. Hart [1977] 20 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

Various aspects of a water reclamation plant are discussed. The control strategy includes performance objectives, control parameters and analyses required for each unit process. The importance of instrumentation, whether manual or automatic, is considered with respect to its function of monitoring or control. The necessity of comprehensive plant control and maintenance manuals as well as adequately trained personnel is stressed. Procedures for the achievement and maintenance of the high order of treatment reliability expected in a water reclamation plant are given. The necessity of multiple contaminant barriers for the removal of pathogens and toxic or potentially hazardous chemicals are also discussed and substantiated with analytical results. Author

N78-26001# Degremont S. A., Rueil-Malmaison (France).
NITRIFICATION-DENITRIFICATION OF WASTEWATERS WITH A HIGH ORGANIC AND AMMONIA NITROGEN CONTENT (WASTE EFFLUENTS FROM SUGAR REFINERIES)
Gerard-M. Faup, Michel A. Picard, and Claudine DelZappo [1977] 13 p ref Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

Biological removal of nitrogen in the case of sewage is discussed in numerous scientific journals, and a certain number of installations are now in operation. However, considerably fewer articles are published concerning certain industrial waste effluents highly loaded with ammonia and organic nitrogen. Investigation was carried out on the feasibility of applying nitrification or nitrification plus denitrification to waste effluents from sugar mills. These effluents contain a TKN concentration of 100 to 500 mg/l. Two treatment lines were tested on laboratory pilots. Author

N78-26002# Degremont S. A., Rueil-Malmaison (France).
PILOT STUDIES ON THE UTILIZATION OF FLOTATION AND ACCELERATED CLARIFICATION UNITS FOR THE DIRECT PHYSICO-CHEMICAL TREATMENT OF DOMESTIC WASTEWATERS
J. Bebin and J. C. Jacquart [1977] 17 p Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

Two high performance techniques, plate-type clarification and flotation, for liquid/solid separation after the flocculation of raw effluents were studied. The operating principle for the pilot units is discussed. Several treatment plants are compared and results reveal interesting purifications concerning both BOD and

suspended solids climation in small volume apparatus provided that the most appropriate reagents are selected for the effluents in question. G.Y.

N78-26003# Baylor Univ., Houston, Tex. Dept. of Virology and Epidemiology.
CHLORINATION OF SOLIDS-ASSOCIATED COLIPHAGES
C. H. Stagg, C. Wallis, C. H. Ward, and C. D. Gerba [1977] 8 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater Prepared jointly with Rice Univ., Houston, Tex.
Avail: NTIS HC A02/MF A01

The effect that association of coliphages with suspended solids has on disinfection by chlorine was investigated. Changes in the numbers of both freely suspended and solids-associated coliphages were observed during passage of effluent through municipal chlorine contact chambers. Solids-associated coliphages were more resistant to chlorination than were freely suspended coliphages. Laboratory studies demonstrated that most of the solids-associated phages were adsorbed to the surface of sewage solids rather than embedded. Author

N78-26004# South African Water Information Centre, Pretoria.
SOURCES OF INFORMATION FOR THE SCIENTIST AND ENGINEER CONCERNED WITH ADVANCED TREATMENT AND RECLAMATION OF WASTE WATER
P. J. Aucamp [1977] 7 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

Information on advanced treatment of waste water is distributed among many different sources. This paper will endeavour to point out most of the important sources available. The ordinary scientist and engineer find it increasingly difficult to handle the information available without some external aid. Modern information handling techniques and other available aids such as computers must be used as efficiently as possible. Information central in various disciplines and fields of application were created to help the researchers to manage the information flood. Author

N78-26005# City Engineer's Dept., Salisbury (Rhodesia).
PHYSICO-CHEMICAL TREATMENT OF RAW SEWAGE
J. McKendrick [1977] 10 p Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

The sewage treatment processes for a South African sewage treatment plant were investigated. Results are given for the analysis of a laboratory pilot plant and a works pilot plant. The analysis focused on problems encountered with alum dosing and coagulant aids. Laboratory trials were run with a clinoptilolite column to remove ammonia with the results demonstrating the selectivity of this zeolite for the ammonium cation. The treatment of the sludge produced by the water treatment process is also investigated. G.Y.

N78-26006# Abwasserverband Ampergruppe, Eichenau (West Germany).
HYGIENIZATION OF SEWAGE SLUDGE BY GAMMA IRRADIATION: EXPERIENCE WITH AN OPERATING PILOT PLANT
T. Lessel and A. Suess [1977] 17 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

A pilot plant for the gamma irradiation of sewage sludge was built in 1972/73 for practical testing and research purposes. This plant with a maximum daily capacity of 150 cu m sludge had been operating during a test-period of 28 months with daily capacity of 30 cu m. From December 1975 the plant has been irradiating 120 cu m of sludge per day. Author

N78-26007# North Dakota State Univ., Fargo. Dept. of Civil Engineering.
ULTRAFILTRATION AND HYPERFILTRATION OF PHENOLIC COMPOUNDS IN COAL GASIFICATION WASTEWATER STREAMS
Stanley L. Klemetson and Monte D. Scharbow [1977] 14 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater Sponsored in part by DOE (Grant NSF ENG-75-10251)
Avail: NTIS HC A02/MF A01

The treatment of phenolic compounds from coal gasification plants using ultrafiltration and hyperfiltration is presented. Dynamically formed hydrous zirconium (IV) oxide membranes on several types of supports were the focus of the investigation. The pH variations of 6.5 to 11, pressure variations of 250 to 1000 psig (1724 to 6895 kPal), and concentration variations of 1 to 400 mg/1 were examined. Phenol reductions greater than 95 percent were obtained with several membranes, and flux rates were greater than 100 gpd/sq ft (4.08 cu m/day/sq m). Author

N78-26008# National Inst. for Water Research, Pretoria (South Africa).
REFINEMENT OF A CHLORINATION PROCESS UNIT IN WATER RECLAMATION: TECHNOLOGICAL AND COST IMPLICATIONS
J. vanLeeuwen and W. R. Ross [1977] 9 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

When chlorine is used for the purpose of disinfection in water reclamation, removal of ammonia by chlorination to the breakpoint is essential. For average ammonia nitrogen concentrations below 5 mg lambda/1 (as N) breakpoint chlorination can economically remove all ammonia and ammonia stripping is not required. Chlorine can also partially be used to replace carbon dioxide for pH adjustment. This leads to savings in sodium hydroxide and carbon dioxide without an increase in chlorine consumption. Chlorine consumption can be minimized by maintaining a pH of 7. Elimination of ammonia stripping, integration of chlorination with recarbonation and stabilization, led to a reduction of 10% in total reclamation costs. Author

N78-26009# National Inst. for Water Research, Pretoria (South Africa).
CENTRIFUGAL DEWATERING OF LIME SLUDGES FROM WATER RECLAMATION PLANTS
M. Ronen and F. A. vanDuuren (Pretoria Univ., Brooklyn, S. Africa) [1977] 11 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

Lime sludges are being dewatered in two solid bowl centrifuges at a water reclamation plant. Preliminary experimental results are presented and the behavior of the sludge in the centrifugation process is discusssed. A model to describe the centrifugal dewatering of the lime sludges is proposed. The model is being evaluated by means of laboratory studies and its coefficients are determined for various types of lime sludges. Author

N78-26010# Missouri Univ., Rolla. Dept. of Civil Engineering.
NEW DESIGN CRITERIA FOR THE AEROBIC DIGESTION OF SEWAGE LIME SLUDGE
Ju-Chang Huang and Kuo-Chun Tsai [1977] 18 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
(Grant OWRT-A-74-MO)
Avail: NTIS HC A02/MF A01

A series of laboratory bench-scale research studies was conducted with a primary objective of establishing a set of design and operational criteria for aerobic digestion of sewage lime sludge which was produced from the phosphorus precipitation with lime in the primary clarifier. All the aerobic digestion studies were carried out at 20 C and special emphasis was placed on the evaluation of various parameters pertinent to the optimal process design and operational control of such a digester system. Author

N78-26011# Mekoroth Water Co., Tel Aviv (Israel).
OPERATIONAL EXPERIENCE IN THE LIME TREATMENT OF EFFLUENT FROM OXIDATION PONDS
M. Ronen and Y. Halbertal [1977] 17 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

A pilot plant, solids-contact, reactor-clarifier was used to evaluate operational parameters for the lime treatment of oxidation ponds effluent. The effect of magnesium concentration on the clarification and the lime sludge produced was studied. An earlier finding that a minimum concentration of 40 to 50 mg l/1 is essential to achieve an acceptable level of clarification was confirmed. Conditions under which effluent clarity can be predicted by jar-test studies are discussed. Author

N78-26012# National Inst. for Water Research, Pretoria (South Africa).

CARBON REGENERATION IN SOUTH AFRICA

Ben M. vanVliet [1977] 13 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater

Avail: NTIS HC A02/MF A01

Existing facilities for the regeneration of granular active carbon in South Africa are outlined. The multi-hearth, thermal regeneration plant of the Stander water reclamation system is discussed, with special emphasis on implementation within the local water reclamation context. Experimentation at this plant, which led to the development of criteria for furnace operation, is described. Product characteristics, including physical properties, adsorptive capacities, pore size distributions and other quality definitive parameters are discussed. The quality of the process water using regenerated carbon is compared with that using virgin carbon. A cost evaluation of the thermal regeneration process within a water reclamation system is given for local conditions. Special emphasis is placed on the dependence of regeneration costs on the capacity of the water reclamation plant. Labor and energy requirements are also explored. Author

N78-26013# State Agricultural Univ., Wageningen (Netherlands).

THE USE OF FLOCCULATED POWDERED ACTIVATED CARBON IN WATER TREATMENT

Gatze Lettinga, Willem A. Beverloo, and Willem C. VanLier (Norit N. V., Amersfoort, Netherlands) [1977] 22 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater

Avail: NTIS HC A02/MF A01

The feasibility of applying flocculated powdered activated carbon in water treatment processes was studied. Various types of commercially available polymeric flocculants were involved in the study. It is shown that for most solutes investigated, the rate of adsoption on flocculated activated carbon is somewhat lower as compared to nonflocculated carbon. On the other hand the adsorption capacity as measured after twenty-four hours of contact appeared to be higher with the flocculated carbon with all solutes investigated. Experiments in a continuously or intermittently stirred Upflow Flocculated Powdered Carbon (UFPC) adsorber revealed that an effective removal of adsorbates can be attained at a high average degree of utilization of the adsorption capacity of the carbon. In the treatment of chemically clarified sewage, anionic flocculants are most effective in resisting and/or preventing deflocculation of the carbon flocs. Author

N78-26014# Norit N. V., Amersfoort (Netherlands).

THE APPLICATION OF ACTIVATED CARBON FOR WASTE WATER TREATMENT

W. C. vanLier, E. vandenBerg, and G. Lettinga [1977] 46 p refs Presented at the Intern. Conf. on Afvan. Treat. and Reclamation of Wastewater Prepared in cooperation with Haskoning, Consulting Engineers, Nijmegen and State Agricultural Univ., Wageningen

Avail: NTIS HC A03/MF A01

The results of the carbon treatment step of an independent physico-chemical (ipc) study, applied on sewage of purely domestic origin are reported. In the study two types of carbon were used, powdered activated carbon (pac) and granular activated carbon (gac). Comparison is made between pac and gac runs, along with comparisons with other investigators. G.Y.

N78-26015# Natal Univ., Durban (South Africa). Dept. of Chemical Engineering.

TEXTILE SIZE AND WATER RECOVERY BY MEANS OF ULTRAFILTRATION

G. R. Groves, C. A. Buckley, and G. L. Dalton (Natl. Inst. for Water Res., Pretoria, S. Africa) [1977] 16 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater

Avail: NTIS HC A02/MF A01

An ultrafiltration system has been developed to concentrate polyacrylate sizes for reuse from desizing effluents. Washer configuration and water usage is shown to affect the desizing efficiency which determines the concentration factor needed for the ultrafiltration stage. The effect of feed concentration and pressure driving force on the permeate flux is described. Author

N78-26016# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Chemical Technology Div.

AMMONIA STRIPPING WITH SPRAY TOWERS

S. Y. Ip and W. G. C. Raper [1977] 27 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater

Avail: NTIS HC A03/MF A01

Because there is no packing material involved, spray towers, when used as ammonia stripping towers, can overcome the problem of calcium carbonate scale formation inside the towers, thus reducing capital cost, maintenance cost and air power consumption due to lower air pressure drop, which may be offset slightly by increased water pumping costs. For given plant capacity, climate conditions and sewage temperature, the operating cost depends on the degree of ammonia removal desired. Thus different stripping processes can only be compared by a method which takes all these factors into account. A graphical technique for comparison of the performance of different ammonia stripping towers is presented and used to compare preliminary operating results obtained from 0.9, 1.8, and 3.7m spray towers with published data from conventional packed towers. Author

N78-26017# Adamas Paper Mill (Pty) Ltd., Port Elizabeth (South Africa).

DISSOLVED AIR FLOTATION TREATMENT OF PAPER MILL EFFLUENT

J. A. Coerze [1977] 11 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater

Avail: NTIS HC A02/MF A01

The treatment removes about 98% of suspended cellulose fibre (about 5 ton per day) from the effluent through part stream aeration of pressurised clarified water. Chemical treatment, apart from alum which is normally present in the papermaking process, consists of lime for pH correction and a polyelectrolyte for flocculation improvement. The floated sludge is removed from a rectangular vessel by means of a rake. After thickening in a screw press to about 20% consistency, impurities are removed and accepted pulp is recycled. A portion of the final clarified effluent is re-used. The remainder complies with the local municipal specifications for discharge to the municipal sewer. Details are given of exhaustive laboratory experimentation which indicated the obvious advantages of flotation over sedimentation. The practical operating experience of the plant over three years is given. Author

N78-26018# National Inst. for Water Research, Pretoria (South Africa).

THE OCCURRENCE AND FATE OF ORGANIC MICRO-POLLUTANTS IN A WATER RECLAIMED FOR POTABLE REUSE

J. F. J. vanRensburg, P. G. vanRossum, and W. H. J. Hattingh [1977] 11 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater

Avail: NTIS HC A02/MF A01

The occurrence of toxic compounds such as chlorinated pesticides, organophosphate pesticides, polynuclear aromatic hydrocarbons, volatile halogenated hydrocarbons and organic material in the feed and the final water produced by the Stander reclamation plant is described. In addition, the efficacy of a pilot reclamation plant to remove a number of selected organic compounds was also studied. It is concluded that the water reclamation for potable reuse by the Stander reclamation plant should permit little, if any, health hazard. It was also shown that the pilot reclamation plant was very effective in removing organic compounds such as those observed in the reclaimed water from the Stander plant. Author

N78-26019# National Inst. for Water Research, Pretoria (South Africa).

PHYSICAL-CHEMICAL RECLAMATION OF LAUNDRY EFFLUENTS

J. H. Nell and C. N. Windt [1977] 14 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater

Avail: NTIS HC A02/MF A01

The recycling of approximately half of the rinsing effluent to the washing stages by means of the cascade principle reduces intake water consumption in laundries by up to 66%. Physical-chemical reclamation of the remaining rinsing effluent, as well as all of the washing effluent, results in a theoretical 100% reduction. Results obtained with a 1l min/1 pilot plant show that the reclamation of laundry effluents is a feasible proposition. The effect of the type of effluent and effluent temperature on plant performance is discussed, while increased salinity and microbiological quality of effluents are also considered. Author

N78-26020# Michigan Univ., Ann Arbor. Environmental and Water Resources Engineering.

INTEGRATED BIOLOGICAL AND PHYSICOCHEMICAL TREATMENT FOR RECLAMATION OF WASTEWATER

Walter J. Weber, Jr. and Wei-Chi Ying [1977] 24 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater

(Grant NSF ENG-71-02475)

Avail: NTIS HC A02/MF A01

Physicochemical treatment - fundamentally, chemical precipitation/coagulation, activated carbon adsorption, and ancillary treatments for nitrogen removal and reduction of dissolved salts - were demonstrated technically and economically feasible for advanced treatment and reclamation of waste water. An alternative treatment system is proposed, and the results of laboratory and field studies detailed. The system is an integrated biological and physicochemical treatment process in which the activated carbon component, operated in expanded-bed mode, serves the dual functions of adsorption and thin-film biological reaction. Author

N78-26021# Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Water Research.

NITRIFICATION AND DENITRIFICATION OF LIME-TREATED WASTEWATERS

Lucas R. J. VanVuuren and Sybrandus G. Wiecher [1977] 14 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater

Avail: NTIS HC A02/MF A01

A pilot plant was erected in Pretoria South Africa to study the integration of chemical and biological processes for the advanced treatment of wastewater. The plant was flexibly designed to enable the study of various process sequences following the primary lime clarification stage. The evaluation of two process systems which showed the greatest potential during the preliminary studies is discussed. The sequence of the first comprised the high rate recycling of nitrified effluent to an anoxic reactor positioned between the lime clarification and biological oxidation stages. In the second system, the anoxic reactor followed the biological oxidation stage, thereby excluding the need for recycling. Process criteria for the two process systems were established, and cost comparisons made in terms of chemical requirements. Author

N78-26022# Technion - Israel Inst. of Tech., Haifa. Environmental Engineering Research Center.

COMBINATION OF PHYSIO-CHEMICAL AND BIOLOGICAL PROCESSES FOR WASTEWATER TREATMENT AND REUSE. BIOLOGICAL TREATMENT WITH NITRIFICATION FOLLOWING CHEMICAL FLOCCULATION-CLARIFICATION OF RAW WASTE-WATER

Menahem Rebhun, Nava Narkis, and Chaim Sheindorf [1977] 19 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater

Avail: NTIS HC A02/MF A01

Chemical flocculation-clarification of raw sewage was found to be an excellent primary treatment step, preceding biological treatment with nitrification. Removal of many toxicants, such as heavy metals and interfering organic oil and fats and a higher than 50 percent reduction in organic load, enables highly efficient and reliable nitrification. Experimental data collected from continuous flow bench scale and pilot plant units, showed that complete nitrification of high ammonia content wastewater was obtained at hydraulic residence times of 2.5 to 3 hrs in case of chemical flocculated wastewater vs. 5 to 6 hrs for plainly settled raw wastewater. Kinetic analysis of the experimental data showed that the nitrification reaction coefficient was 60 percent higher in the case of CFS as compared to SS. Critical sludge retention time was 4.5 days for CFS as compared to 8 days for SS. Removal of organic substrate was excellent, producing a uniform effluent. Author

N78-26023# Akvadan-Harvey A/S, Bagsvaerd (Denmark).

SIMULTANEOUS PRECIPITATION OF PHOSPHORUS, BOD REMOVAL, NITRIFICATION AND DENITRIFICATION IN FULL SCALE PRACTICE

Erik Bundgaard and Bent Tholander [1977] 11 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater

Avail: NTIS HC A02/MF A01

A 21,000 cu m d (5.5 MGD) extended aeration plant is described. The treatment plant is unique in that it combines the Bio-Denitro process, i.e., BOD removal, nitrification and denitrification in a complete-mix reactor system featuring alternating feeding and discharge, along with simultaneous precipitation of phosphorus. Dual medium downflow filtration is included as a safety and polishing feature. Capital costs of the system compare favourably with those of other systems without phosphorus and nitrogen removal. Operating costs are also favourable since phosphorus removal is accomplished with inexpensive ferrous sulphate as the precipitant, and denitrification is carried out with raw wastewater as the carbon source. Author

N78-26024# Ruhr Reservoir Association, Essen (West Germany).

WASTEWATER FROM PLATING WORKS: REQUIRED PRETREATMENT AND DISPOSAL OF CONCENTRATES

Klaus R. Imhoff [1977] 18 p refs Presented at the Intern. Conf. on Advan. Treat and Reclamation of Wastewater

Avail: NTIS HC A02/MF A01

Suggested standards for maximun concentrations of heavy metals in wastewater indicate the need for considerable pretreatment of the effluent from metal finishing industries in the Ruhr Valley before discharge into the sewers for treatment along with domestic sludge. The need for centralized waste water treatment plants and their appropriate design are discussed, as well as the construction of centralized decontamination plants and the maintenance of controlled hydroxide deposits. These measures, coupled with low flow augmentation by reservoirs, polishing of river water in impounding lakes, and the preparation of drinking water by low filtration finally result in good water quality. Author

N78-26025# Technion - Israel Inst. of Tech., Haifa. Sherman Environmental Engineering Research Center.

USE OF OZONE IN WATER RENOVATION. PART 1: REMOVAL OF ORGANIC MATTER FROM EFFLUENTS BY LIME TREATMENT, OZONATION AND BIOLOGICALLY EXTENDED CARBON ADSORPTION

Alberto M. Wachs, Nava Narkis, Malka Schneider, and Pinhas Wasserstrom [1977] 12 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater

Avail: NTIS HC A02/MF A01

Two different approaches to the use of ozone for organic matter removal in water renovation have been investigated. In both cases the renovation system started with biological and high-lime treatment. Chemical oxidation of the remaining organic matter would require very large amounts of ozone. A more promising approach seems to be to use ozone to promote biodegradability of the residual organics and subsequently use biologically active carbon adsorbers. Experimental work with this system has produced water with a TOC of less than 2 mg e/1. Author

N78-26026# Mondi Paper Co., Durban (South Africa).

THE RECLAMATION OF PROCESS WATER FROM SEWAGE EFFLUENT AND THE REUSE OF MILL EFFLUENTS AND SOLIDS AT MONDI PAPER COMPANY, DURBAN, SOUTH AFRICA

A. Giampietri, J. W. Funke, and J. A. Voysey [1977] 13 p

refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

The Mondi paper mill, consisting of a groundwood pulp mill and three paper machines for the production of newsprint and fine paper grades, was designed to use up to 12,000 kl/d of treated sewage effluent from the nearby Durban southern sewage works as process water. Since the start-up in 1971/1972, the quality of the reclaimed water has been such that no difficulties have been encountered in the production, even with water reclaimed from sewage as the only process water supply. The specific water intake to the mill has been reduced from 50 kl/t, mainly by internal water saving measures. The reclamation of paper solids from mill effluents by external treatment facilities is such that, during 1976, an average of 75% of these solids were returned to the process. Author

N78-26027# Johannesburg City Council (South Africa).
PROBLEMS ASSOCIATED WITH THE REUSE OF PURIFIED SEWAGE EFFLUENTS FOR POWER STATION COOLING PURPOSES
R. A. Flook [1977] 12 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

Purified sewage effluent for cooling purposes has been used successfully at Johannesburg's power stations over a long period. In recent years, gradual changes in the quality of the effluent resulting in increased alkalinity, have taken place. The reasons for these changes and their effects in causing scaling problems on heat exchanger surfaces, are discussed. Author

N78-26028# AWWA Research Foundation, Denver, Colo.
POTABLE REUSE RESEARCH
Richard D. Heaton [1977] 14 p Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

The activities of ten water utilities and federal agencies in the U.S. relating to wastewater reclamation and reuse for potable purposes as contrasted to more conventional methods of reuse, are reported. The renovation of sewage effluents to a water product suitable for human use and consumption is being demonstrated in any of three ways: (1) direct potable reuse or the classical pipe-to-pipe definition where highly treated wastewaters from a reclamation plant are reintroduced into the existing water distribution system; (2) planned indirect reuse or the purposeful and knowledgeable discharge of highly treated effluents upstream of an existing water supply intake; and (3) groundwater recharge with spreading or injection of advanced water treatment effluents into a potable aquifer. Author

N78-26029# Tulane Univ., New Orleans, La. School of Public Health.
POTABLE WATER QUALITY OF ADVANCED WASTEWATER TREATMENT PLANT EFFLUENTS
A. J. Englande, Jr., James K. Smith (Gulf S. Res. Inst., New Orleans), and John N. English (EPA, Cincinnati) [1977] 41 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A03/MF A01

Extensive chemical, physical, and biological analyses of effluent quality from six advanced water treatment (AWT) demonstration facilities were conducted, and the results were compared to current drinking water regulations in the United States. Those pilot plant sites evaluated included: Lake Tahoe, California; Blue Plains, District of Columbia; Pomona, California; Dallas, Texas; and Escondido and Orange County, California. Each AWT plant is described and respective performance parameter summaries are provided. Parameters which were found to exceed drinking water standards in most of the treated effluents included: nitrogen (ammonia and nitrate), phenol, odor, CCE, turbidity, and specific heavy metals. All systems, however, were characterized by high quality effluents and produced water approaching potable quality. Author

N78-26030# California Univ., Irvine.
PUBLIC ACCEPTANCE OF EXPANDED USES OF RENOVATED WASTEWATER
Betty H. Olson [1977] 11 p refs Presented at the Intern. Conf. on Advan. Treat. and Reclamation of Wastewater
Avail: NTIS HC A02/MF A01

To determine attitudes toward expanded uses of reclaimed water, a survey of 153 adults living in a California community currently using renovated wastewater was conducted. Many respondents were not aware that reclaimed water was being used in their community. Most respondents which were aware of renovated wastewater use in the community could not identify areas which received reclaimed water. Individuals surveyed were in favor of using reclaimed water to supplement existing water supplies as long as the uses were not in the home. Public attitude was favorable to reclaimed water practices such as car washes, industrial use, and commercial laundries. Men accepted reclaimed water more than women. Education was an important variable in determining attitudes towards renovated wastewater. College graduates had a higher level of acceptance than noncollege graduates. Certain psychological variables: aversion to the unclean, aversion to human waste, and overconcern with health were found to be negatively correlated with attitudes toward reclaimed water usages. Other psychological variables: faith in science and technology, ecological concern and aversion toward change were found to have no effect on attitudes toward reclaimed water. Author

N78-26031*# National Aeronautics and Space Administration, Washington, D. C.
NASA TECH BRIEFS INDEX 1976
1976 123 p
(NASA-SP-5021(17)) Avail: NTIS HC A06/MF A01 CSCL 05A

Abstracts of new technology derived from the research and development activities of the National Aeronautics and Space Administration are presented. Emphasis is placed on information considered likely to be transferrable across industrial, regional, or disciplinary lines. Subject matter covered includes: electronic components and circuits; electronic systems; physical sciences; materials; life sciences; mechanics; machinery; fabrication technology; and mathematics and information sciences. Author

N78-26032# California Univ., Berkeley.
THE URBAN TRAVEL DEMAND FORECASTING PROJECT, PHASE 1, VOLUME 5 Final Report
D. McFadden, A. Talvitie, S. Cosslett, Ibrahim Hasan, Michael Johnson, Fred A. Reid, and Kenneth Train Jun. 1977 590 p refs
(Grants NSF GI-43740; NSF APR-74-20392)
(PB-277381; NSF/RA-770328-Vol-5) Avail: NTIS HC A25/MF A01 CSCL 13F

Data collected on a sample of individual commuters in the San Francisco Bay Area before the initiation of Bay Area Rapid Transit (BART) service are presented. The BART patronage is predicted from demand models fitted to the pre-BART Data. The predictions are compared with actual BART patronage, using a second survey taken after BART was in service. Attention is concentated on work mode-choice. These studies demonstrate disaggregate travel demand forecasting to be a practical policy analysis tool. The limitations of the current generation of these models are spelled out, and it is suggested that considerable care is needed in their application to new mode forecasting, and in transferring models across populations. GRA

N78-26033# Stanford Univ., Calif. Dept. of Civil Engineering.
DEVELOPMENT OF RESEARCH IN THE CONSTRUCTION OF TRANSPORTATION FACILITIES: A STUDY OF NEEDS, OBJECTIVES, RESOURCES, AND MECHANISMS FOR IMPLEMENTATION Final Report, 30 Sep. 1977
Boyd C. Paulson, Jr., John W. Fondahl, and Henry W. Parker Sep. 1977 32 p
(Contract DOT-OS-60150)
(PB-277420; SU-TR-224) Avail: NTIS HC A03/MF A01 CSCL 13F

An in-depth research study to: (1) evaluate and quantify the current and projected state of productivity in the construction of transportation facilities; (2) determine areas having the highest potential economic returns and the greatest needs where research could lead to improvements in technology and management that in turn could lead to improved productivity; quantify decision-making criteria where possible; (3) assess the present

and potential interests and capabilities of institutions - universities in particular - that would do such research in transportation construction; and (4) explore improved mechanisms for implementing transportation construction innovations are described. It is evident that some of the major obstacles that impact costs slow productivity and inhibit the implementation of innovations result from: (1) decisions made and policies set during the planning and design phases; and (2) the contractual and organizational structure chosen for project administration. There are also major opportunities for improvements through wider and more effective use by construction contractors of management techniques that have already proven to be successful. GRA

N78-26034# Stanford Univ., Calif. Dept. of Civil Engineering.
DEVELOPMENT OF RESEARCH IN THE CONSTRUCTION OF TRANSPORTATION FACILITIES: A STUDY OF NEEDS, OBJECTIVES, RESOURCES, AND MECHANISMS FOR IMPLEMENTATION
Boyd C. Paulson, Jr., John W. Fondahl, and Henry W. Parker Sep. 1977 151 p refs
(Contract DOT-OS-60150)
(PB-277419; SU-TR-223) Avail: NTIS HC A08/MF A01 CSCL 13F

For abstract see, N78-26033.

N78-26035# George Washington Univ., Washington, D. C. Dept. of Chemistry.
ELECTROMETRIC DETERMINATION OF METALS IN WASTE WATERS CONTAINING SURFACTANTS: SUITABILITY OF DIFFERENTIAL PULSE ANODIC STRIPPING VOLTAMMETRY AT AN HANGING MERCURY DROP ELECTRODE Final Technical Report, 30 Apr. 1976 - 30 Sep. 1977
Timothy A. Getek and William E. Schmidt Mar. 1978 96 p refs
(Contract N00173-76-C-0193)
(AD-A053287) Avail: NTIS HC A05/MF A01 CSCL 13/2

The investigation was pursued as one aspect of a water extractable constituents research program. Knowledge was needed concerning the effect of organic constituents on the electrometric determination of metals in such waste waters as bilge discharge. Hence the electrodics of organics, including surfactants and their effect on the reactions of metal ions--for example, copper, lead, cadmium, and zinc--were studied. The relatively recent technique of differential pulse anodic stripping voltammetry was explored as the prime electrometric method. The application of anodic stripping to trace determinations in a variety of samples has been documented in the literature. This distinctive technique suffers from some of the common interferences and complications inherent in all work at low concentrations. Interferences unique to this method--intermetallic compound formation and surface active substances -- were examined in the differential pulse anodic stripping voltammetric mode with an hanging mercury drop electrode. A review was also undertaken to compile relevant literature on stripping analysis. GRA

N78-26036# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Advanced Energy Storage Systems.
DEVELOPMENT SCHEDULES FOR VEHICLE ENERGY STORAGE SYSTEMS
1977 25 p refs
(Contract EY-76-C-02-2708-012)
(TID-28030) Avail: NTIS HC A02/MF A01

The development of advanced energy storage systems for electric and hybrid electric powered vehicles is discussed. A minimum of one year for flywheels and two years for batteries will be necessary to translate most laboratory concepts into production prototype designs with a minimum of testing to establish confidence in the anticipated performance. ERA

N78-26037# Swedish Water and Air Pollution Research Lab., Stockholm.
ENERGY ASPECTS ON AEROBIC AND ANAEROBIC PROCESSING OF SEWAGE
B. Frostell Jul. 1977 13 p refs In SWEDISH
(IVL-B-380) Avail: NTIS (US Sales Only) HC A02/MF A01; DoE Depository Libraries

The energy consumption of different operations in the biological purification process, such as pumping, heating, oxygen supply, sedimentation and sludge transportation was studied. The energy gain from methane production was also considered. The net energy balance was calculated for some different concentrations of biological material in the sewage. ERA

N78-26038# Oak Ridge National Lab., Tenn.
SOLID WASTE UTILIZATION: PYROLYSIS
William J. Boegly, Jr., William R. Mixon, Clark Dean (Hamilton Std. Div., United Aircraft Corp., Windsor Locks, Conn.), and Daniel J. Lizdas (Hamilton Std. Div., United Aircraft Corp., Windsor Locks, Conn.) Aug. 1977 77 p refs Prepared for Argonne Natl. Lab., Ill.
(Contract W-31-109-eng-38)
(ANL/CES/TE-77-15) Avail: NTIS HC A05/MF A01

The use of pyrolysis is considered as a method of producing energy from municipal solid waste. The energy can be in the form of a gas, oil, chars, or steam. Pyrolysis, the decomposition of organic matter in the absence of oxygen (or in an oxygen-deficient atmosphere), is used to convert organic matter to other products or fuels. This process is also described as destructive distillation. Four processes are described in detail: the Landgard System (Monsanto Environ-Chem Systems, Inc.); the Occidental Research Corporation Process. Also included is a listing of other pyrolysis processes currently under development for which detailed information was not available. ERA

N78-26039# Little (Arthur D.), Inc., Cambridge, Mass.
STUDY OF FUTURE HEAT ENGINE VEHICLE SYSTEMS Final Report
D. A. Hurter Jul. 1977 31 p Prepared for California Univ., Lawrence Livermore Lab.
(Contract W-7405-eng-48)
(UCRL-13781) Avail: NTIS HC A03/MF A01

The vehicles considered are all extensions of present heat engine technology. Data are given on the change in fuel economy, incremental change in consumer cost, and total vehicle weight by vehicle size for each of the time periods. The most likely technical improvements and the timing for their introduction are indicated. Fuel economy is possible with relatively low technical risk until the years 1990-2000. ERA

N78-26040# National Technical Information Service, Springfield, Va.
WASTEWATER TREATMENT USING FLOCCULATION, COAGULATION, AND FLOTATION, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Feb. 1978
Diane M. Cavagnaro Mar. 1978 154 p Supersedes NTIS/PS-77/0056; NTIS/PS-76/0790; NTIS/PS-75/582
(NTIS/PS-78/0246; NTIS/PS-77/0056; NTIS/PS-76/0790; NTIS/PS-75/582) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Flocculation, coagulation, and flotation studies for sewage and industrial waste treatment processes are presented in this bibliography of Federally-funded research. The processes, flocculants, coagulants, performance, and effectiveness are covered. Author

N78-26041# National Technical Information Service, Springfield, Va.
WASTEWATER TREATMENT USING FLOCCULATION COAGULATION, AND FLOTATION. CITATIONS FROM THE AMERICAN PETROLEUM INSTITUTE DATA BASE Progress Report, 1968 - Mar. 1978
Diane M. Cavagnaro Mar. 1978 149 p Supersedes NTIS/PS-77/0057
(NTIS/PS-78/0247; NTIS/PS-77/0057) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

The bibliography presents results of worldwide work on treating industrial waste waters to remove pollutants, with emphasis on the petroleum and chemical industries. The methods used are flocculation, coagulation, or flotation. Theoretical studies, basic research, engineering, and full-scale plants are reported. Author

N78-26042# National Technical Information Service, Springfield, Va.

WASTEWATER TREATMENT USING, FLOCCULATION, COAGULATION, AND FLOTATION, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964-1975
Diane M. Cavagnaro Mar. 1978 170 p
(NTIS/PS-78/0245) Copyright. Avail: NTIS HC $28.00.MF $28.00 CSCL 13B

This bibliography of Federally-funded research contains flocculation, coagulation, and flotation studies for sewage and industrial waste processes. The citations cover the processes, flocculants, performance, and effectiveness. Author

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N78-26043*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF DIGITAL IMAGE PROCESSING TECHNIQUES TO ASTRONOMICAL IMAGERY 1977
Jean J. Lorre and Donald J. Lynn 15 Apr. 1978 64 p refs
(Contract NAS7-100)
(JPL-Pub-78-17) Avail: NTIS HC A04/MF A01 CSCL 03A

Nine specific techniques of combination of techniques developed for applying digital image processing technology to existing astronomical imagery are described. Photoproducts are included to illustrate the results of each of these investigations. Author

N78-26044# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OPTICAL EFFICIENCY MEASUREMENTS OF GOEDSS ETS TELESCOPES FROM 1 JULY 1976 TO DECEMBER 1977
E. W. Rork 27 Feb. 1978 16 p refs
(Contract F19628-78-C-0002)
(AD-A053203; ETS-32) Avail: NTIS HC A02/MF A01 CSCL 20/6

Optical efficiency measurements are reported for five telescopes used with the GEODSS Experimental Test System. The measurements were taken and the results indicate gradual decreases in the optical efficiencies of the telescopes with use. The decreases in optical efficiencies are due to dust which accumulated on the optical surfaces of the telescopes during ETS operations. GRA

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N78-26045# California Univ., Livermore. Lawrence Livermore Lab.
PRESUPERNOVA EVOLUTION OF MASSIVE STARS
T. A. Weaver, G. B. Zimmerman, and S. E. Woosley 15 Dec. 1977 28 p ref
(Contract W-7405-eng-48; Grant NSF AST-76-10933)
(UCRL-80460) Avail: NTIS HC A03/MF A01

Population 1 stars of 15 M/sub mass/ and 25 M/sub mass/ have been evolved from the zero-age main sequence through iron core collapse utilizing a numerical model that incorporates both implicit hydrodynamics and a detailed treatment of nuclear reactions. Both stars are found to form substantially neutronized iron cores of 1.56 M/sub mass/ and 1.61 M/sub mass/, and central electron abundances of 0.427 and 0.439 moles/g, respectively, during hydrostatic silicon burning. Just prior to collapse, the abundances of the elements in the 25 M/sub mass/ star (excluding the neutronized iron core) have ratios strikingly close to their solar system values over the mass range from oxygen to calcium, while the 15 M/sub mass/ star is characterized by large enhancements of Ne, Mg, and Si. ERA

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

No abstracts in this category.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N78-26046# Air Force Geophysics Lab., Hanscom AFB, Mass.
HIGH RESOLUTION SOLAR RADIO ACTIVITY INVESTIGATIONS
Ronald M. Straka 8 Nov. 1977 44 p refs
(AD-A053167; AFGL-TR-77-0247; AFGL-ERP-613) Avail: NTIS HC A03/MF A01 CSCL 03/2

The study of cm-mm wavelength radio emission from solar active regions to find flare/proton flare predictors was the task of AFGL's In-House Work Unit 46430302, High Resolution Solar Activity Investigations. Using mapping data from several large radio telescopes, the multi-wavelength active region data was evaluated for significant prediction parameters. A statistical examination of 681 solar-region measurements obtained at wavelengths of 9.1 cm (Stanford), 8 mm (AFCRL), and 3 mm (Aerospace) from 1968 to 1970 was made and related to 25 proton events. Of the 21 different correlation parameters evaluated, the apparent 3 mm flux density, particularly when it exceeded 10 s.f.u., provided the best indication that a region would produce a proton flare. Results of the 21 August 1975 proton-flare observations using the 120 ft Haystack radiotelescope at 3.8 cm are discussed. The solar region involved had a low, and decreasing, brightness temperature before it flared, and not the polarization variations often seen prior to flares. The noise power spectrum analysis of active-region temperature and polarization variations is described. A significant power component was found at 43 mHz (23 sec period) in preflare polarization variations; no such component was found for preflare temperature. Recommendations for future areas of investigation using high-resolution solar radio instrumentation are suggested. Author (GRA)

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

No abstracts in this category.

99 GENERAL

No abstracts in this category.

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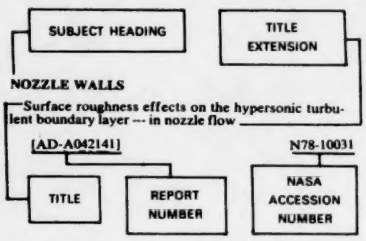

The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

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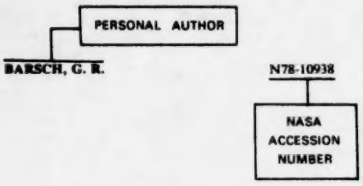

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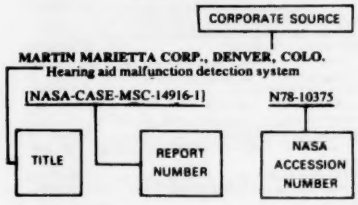

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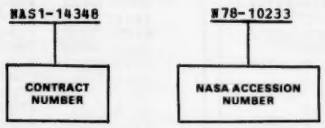

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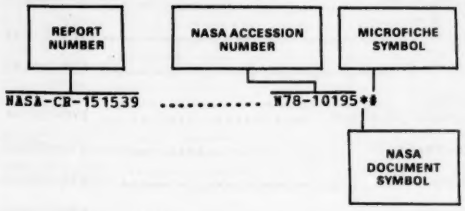

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NRL-8058 ..... N78-25418 #
NRL-8201 ..... N78-25169 #
NRL-8212 ..... N78-25818 #

NRTC-78-13R ..... N78-25896 #

NSF/PRA-7402411/1/8 ..... N78-25969 #
NSF/PRA-7515637/1/8 ..... N78-25318 #
NSF/RA-770204 ..... N78-25983 #

NSF/RA-770243 ..... N78-25664 #
NSF/RA-770328-VOL-5 ..... N78-26032 #

NSWC/WOL-TR-78-11 ..... N78-25778 #

NTIS/PS-75/101 ..... N78-25684 #
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NTIS/PS-78/0325 ..... N78-25977 +

NUREG-CR-0004 ..... N78-25814 #

ONR-CR-289-020-1F ..... N78-25062 #

ORNL-SUB-4485-1 ..... N78-25864 #

ORNL-TM-5909 ..... N78-25255 #
ORNL-TM-5983-PT-2 ..... N78-25934 #
ORNL-TM-6000 ..... N78-25576 #
ORNL-TM-6011 ..... N78-25904 #
ORNL-TM-6029 ..... N78-25182 #
ORNL-TM-6105 ..... N78-25919 #
ORNL-TM-6110 ..... N78-25187 #
ORNL-TM-6137 ..... N78-25605 #
ORNL-TM-6145 ..... N78-25853 #
ORNL-TM-6146 ..... N78-25852 #
ORNL-TM-6177 ..... N78-25177 #
ORNL-TM-6199 ..... N78-25677 #

ORNL-TR-4492 ..... N78-25599 #

ORNL-5279 ..... N78-25647 #
ORNL-5281 ..... N78-25878 #
ORNL-5302 ..... N78-25907 #
ORNL-5326 ..... N78-25468 #
ORNL-5344 ..... N78-25268 #
ORNL-5350 ..... N78-25446 #
ORNL-5353 ..... N78-25181 #
ORNL-5356 ..... N78-25623 #

ORNL/MIT-259 ..... N78-25381 #
ORNL/NUREG-32 ..... N78-25673 #
ORNL/NUREG/CSD-3 ..... N78-25379 #

ORO-4447-064 ..... N78-25160 #
ORO-5017-3 ..... N78-25742 #
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PB-277199 ..... N78-25664 #
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PB-277289 ..... N78-25772 #
PB-277335/6 ..... N78-25318 #
PB-277350 ..... N78-25520 #
PB-277354 ..... N78-25434 #
PB-277356 ..... N78-25258 #
PB-277366 ..... N78-25969 #
PB-277377 ..... N78-25449 #
PB-277381 ..... N78-26032 #
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PB-277501 ..... N78-25198 #
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PB-277676/3 ..... N78-25272 #
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PB-278302 ..... N78-25669 #
PB-278633/3 ..... N78-25406 #

PIFR-959 ..... N78-25654 #

PNC-77-2 ..... N78-25970 #

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PPPL-1409 ..... N78-25943 #

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PWA-5574-12-VOL-1 ..... N78-25166*#

P78-128 ..... N78-25407*#

QPR-1 ..... N78-25619 #
QPR-3 ..... N78-25576 #
QPR-3 ..... N78-25613 #
QPR-4 ..... N78-25248 #
QPR-5 ..... N78-25330 #
QPR-5 ..... N78-25610 #

QR-2 ..... N78-25501*#
QR-2 ..... N78-25577 #
QR-2 ..... N78-25625 #
QR-3 ..... N78-25254 #
QR-3 ..... N78-25519 #
QR-3 ..... N78-25540*#
QR-3 ..... N78-25572 #
QR-4 ..... N78-25541*#
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QR-5 ..... N78-25542*#
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QR-6 ..... N78-25653 #

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RADC-TR-77-406 ..... N78-25312 #
RADC-TR-78-6-VOL-1 ..... N78-25776 #
RADC-TR-78-6-VOL-2 ..... N78-25777 #
RADC-TR-78-23 ..... N78-25794 #
RADC-TR-78-38 ..... N78-25415 #

RAND/R-2171-ARPA ..... N78-25798 #
RAND/R-2175-ARPA ..... N78-25369 #
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REPT-3/77 ..... N78-25353
REPT-78-SPD-809-01 ..... N78-25262 #
REPT-78FM22 ..... N78-25126*#
REPT-110 ..... N78-25705 #
REPT-1099-1-VOL-3 ..... N78-25235*#
REPT-1566-23599 ..... N78-25437 #
REPT-1665 ..... N78-25248 #
REPT-1701-01-1-1728 ..... N78-25050 #
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REPT-013376-5-T ..... N78-25833 #
REPT-760518(MPM-784556) ..... N78-25768 #
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RHO-ST-6 ..... N78-25880 #

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R77-952907-5 ..... N78-25337 #
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R78-1-VOL-2 ..... N78-25986*#
R78-1-VOL-3 ..... N78-25987*#
R78-912839-14 ..... N78-25985*#

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SAI-78-712-WA ..... N78-25839 #

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SAN/1109-8/3-VOL-2-BK-2 ..... N78-25583 #
SAN/1109-8/4-VOL-2-BK-3 ..... N78-25584 #
SAN/1109-8/5-VOL-3 ..... N78-25585 #
SAN/1109-8/8-VOL-6 ..... N78-25586 #
SAN/1111-8/2 ..... N78-25565 #
SAN/1132-2/1-VOL-1 ..... N78-25587 #
SAN/1132-2/2-VOL-2 ..... N78-25588 #
SAN/1132-2/3-VOL-3 ..... N78-25589 #
SAN/1132-2/5-VOL-5 ..... N78-25590 #
SAN/1218-3-VOL-1 ..... N78-25569 #
SAN/1395-14 ..... N78-25519 #

SAND-75-0564 ..... N78-25064 #
SAND-75-0622 ..... N78-25955 #
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SAND-77-0549C ..... N78-25315 #
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SAND-77-0645 ..... N78-25378 #
SAND-77-0930 ..... N78-25402 #
SAND-77-0934 ..... N78-25472 #
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SAND-77-8046 ..... N78-25786 #
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SASR-12 ..... N78-25496*#

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SD-78-AP-0055-1 ..... N78-25107*#
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SDC-TM-5772/004/02 ..... N78-25797 #

SER-50959 ..... N78-25080*#

SKF-AL77T057 ..... N78-25436 #

SLAC-PUB-1732 ..... N78-25858 #
SLAC-PUB-1750 ..... N78-25844 #
SLAC-PUB-1756 ..... N78-25845 #
SLAC-PUB-1886 ..... N78-25889 #
SLAC-PUB-1937 ..... N78-25857 #

SR-2 ..... N78-25325 #
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SR-11 ..... N78-25717 #

SRC-CR-77-32 ..... N78-25326 #

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SRO-0885-75/1 ..... N78-25621 #

SU-IPM-5 ..... N78-25824*#

SU-SEL-78-014 ..... N78-25544*#

SU-SOL-77-25 ..... N78-25817 #

SU-TR-223 ..... N78-26034 #
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TID-27597 ..... N78-25615 #
TID-27778 ..... N78-25571 #
TID-27893 ..... N78-25650 #
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TID-27998 ..... N78-25572 #
TID-28030 ..... N78-26036 #
TID-28036 ..... N78-25859 #
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TID-28043/2 ..... N78-25515 #
TID-28051 ..... N78-25849 #
TID-28058 ..... N78-25513 #
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TID-28104 ..... N78-25643 #
TID-28131 ..... N78-25655 #
TID-28151 ..... N78-25377 #
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TOP-1-3-5 ..... N78-25086 #
TOP-7-3-500 ..... N78-25086 #

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TR-1 ..... N78-25392*#
TR-12 ..... N78-25152 #
TR-16 ..... N78-25973 #
TR-19 ..... N78-25945 #
TR-20 ..... N78-25841 #
TR-54 ..... N78-25524 #
TR-76-219-VOL-1 ..... N78-25569 #
TR-77-33 ..... N78-25150*#
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